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ABSTRACT

Emergency Management education seeks to give students basic information about natural and man-made disasters, preparedness procedures, and survival techniques. The intent of this guide is to aid teachers in presenting disaster survival instruction in the junior high school grades. The materials are designed to supplement existing curricula, where appropriate, and are not intended to be taught as self-contained units of instruction. Materials include student learning objectives, a variety of instructional strategies, student-oriented activities, references, and sample evaluation guides. A media kit, consisting of visuals and handouts, is located at the end of the guide. These pages may be detached and used as masters for handouts without destroying the integrity of the guide. Disasters considered include hurricanes, floods, tornados, thunderstorms, winter storms, heat waves, earthquakes, volcanoes, fires, pollution, and nuclear/radiological emergencies. (Author/JN)

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EMERGENCY MANAGEMENT INSTRUCTION

GRADES 7-9

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EMERGENCY MANAGEMENT INSTRUCTION

INSTRUCTOR'S GUIDE FOR GRADES 7-9

Prepared for the Federal Emergency Management Agency
under contract with the North Carolina Division of
Emergency Management.

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INTRODUCTION

A major emergency or disaster affecting a large number of people can occur anytime and anywhere. It may be a violent act of nature or a result of human error or carelessness. Natural disasters such as hurricanes, tornadoes, floods, blizzards, and earthquakes are common occurrences. With urbanization, industrialization and greater dependence on advanced technology, the threats of man-made disasters have increased. Fires, transportation accidents, explosions, toxic chemical spills, and radiological accidents can threaten an entire community. Of course, the most serious of all man-made disasters would be a nuclear attack on the United States.

To meet the threats of any natural or man-made disaster, it is necessary to understand the hazards of disasters and learn the protective measures necessary to increase the chances of survival. In a disaster, lives can be saved if people are prepared for the emergency and know what actions to take when it occurs.

Emergency Management education seeks to give students basic information about natural and man-made disaster, preparedness procedures and survival techniques. The intent of this guide is to aid teachers in presenting disaster survival instruction in the junior high grades. These materials are designed to supplement existing curricula, where appropriate, and are not intended to be taught as self-contained units of instruction.

It is hoped that this manual will be a flexible instructional aid and will allow for individual classroom needs and teacher preferences. It offers student learning objectives, a variety of teaching procedures, student-oriented activities, references, and sample evaluation guides. A media kit, made up of all visuals and handouts in the Instructor Guide, is located at the end of this volume. These pages may be detached and used as masters for handouts without destroying the integrity of the Instructor Guide. In using this guide, the teacher can be selective in each area and is encouraged to develop individually designed activities to facilitate learning.

This guide represents the work of a group of teachers in North Carolina who participated in developmental workshops and tested the materials in their classrooms. The reported experiences and recommendations of the teachers using the materials have been the basis for this manual.

DISASTERS AND EMERGENCY MANAGEMENT

A natural disaster is an occurrence in nature which threatens the health, safety, or property of a community or larger areas. People have very little or no control over these disastrous phenomena. In contrast, man-made disasters are those which are created by people or are the result of industrial or technological accidents. Regardless of the type of disaster, precautions can be taken to enhance individual and community survival.

ORGANIZATIONS INVOLVED IN EMERGENCY MANAGEMENT

There will always be emergencies and disasters. Emergency Management represents the cooperative effort of numerous government agencies and private organizations involved in planning for and responding to emergencies and disasters. The federal government provides coordination, guidance, and assistance to the states. In turn, the states coordinate federal and state programs that support and strengthen local emergency preparedness programs. The success of any Emergency Management program is determined in the local community since this is where lives and property are saved or lost when disaster strikes.

Local and state governments have the primary responsibility in preparing for emergencies, conducting operations during a crisis, and assisting in recovery measures. Support and assistance for these efforts are provided by the federal government, private organizations, and concerned citizens. Among the organizations involved in emergency and disaster services are the following:

- Fire Department
- Sheriff Department
- Police Department
- Office of Emergency Management
- Emergency Medical Services
- Public Health Department
- Rescue Squad
- Hospitals
- Civil Preparedness Office
- National Guard
- State Police
- National Weather Service
- Federal Emergency Management Agency
- American Red Cross
- Salvation Army
- Utility Companies
- Department of Social Services

FUNCTIONS OF EMERGENCY MANAGEMENT

Emergency Management can be defined as all measures taken to plan and prepare for, respond to, and recover from disasters and hazards of all types, ranging from safety and protection in the home and community to nuclear attack. To mitigate the effects of emergencies and disasters is the ultimate purpose of these emergency preparations and actions.

When a disaster threatens, effective emergency services can minimize the loss of life and property. Citizens must be warned and instructed on the appropriate actions to take. Entire communities may need to be evacuated and people fed and housed until the danger is over. A search in the damaged area for injured people may be necessary. First aid and medical services must be available. Emergency communications will be needed. With careful planning and coordination of these diverse operations, survival chances are greatly enhanced.

DEFINITIONS

Disaster - an occurrence threatening the health, safety or property of a community or larger area. A disaster can be either natural or man-made.

Emergency - an unforeseen combination of circumstances or the resulting state that calls for immediate action.

Emergency Broadcast System (EBS) - broadcasting stations and interconnecting facilities which have been authorized by the Federal Communications Commission to operate in a controlled manner during a war, state of public peril or disaster, or other national emergency.

Emergency Operating Center (EOC) - the protected site from which civil government officials (municipal, county, state, and federal) exercise direction and control in an emergency.

Shelter - a structure or space used to protect its occupants during a natural or man-made disaster, nuclear radiation emergencies, or enemy attack.

Survive - to continue to exist or live after a time, event, or disaster.

WARNING - the alerting of the public to an immediate threat of extraordinary danger, including natural and man-made disasters and enemy attack.

WATCH - an announcement that hazardous conditions are possible and pose a threat to an area.

Weather Advisory - information issued regularly by the National Weather Service to alert the public to possible hazardous conditions that may be caused by severe weather.

LEARNING OBJECTIVE

The student will define disaster and cite examples of natural and man-made disasters.

ACTIVITIES

1. Show a film dealing with a disaster and discuss with the class the nature of the disaster, its causes and effects. The following questions could be useful in introducing the concepts of disaster preparedness and Emergency Management.

   - What is a disaster?
   - Who is affected by disasters?
   - In this film, what preparations had been made to deal with the disaster?
   - Did these preparations have an impact on the effects of the disaster?
   - What were the alerting and warning signals?
   - Who participated in the emergency response and recovery efforts?

2. Have the class compile a list of natural and man-made disasters and determine those which have occurred or are likely to occur in your state and community.
3. Have students create a crossword puzzle using the terms listed on Activity Sheet EM-1.

LEARNING OBJECTIVE

The student will demonstrate a knowledge of the dangers associated with disasters and recognize the need for disaster and emergency readiness.

ACTIVITIES

1. Over a period of several weeks have the students collect newspaper and magazine articles on disasters and emergencies. Make a chart showing the types of disasters reported, the geographic regions affected, and the extent of damage to lives and property. From the information gathered, discuss how disaster readiness did or could have affected the results of the disasters.
2. Have students discuss or write essays on their own personal experiences in a disaster or emergency. Ask each student to explain what preparations and responses would be necessary for possible disasters in the future.
3. Have each student complete the "Guide for Family Emergency Planning" (Activity Sheet EM-2) with his or her family. Encourage the students to use the planning guide in their homes and conduct emergency drills for disasters most likely to occur in your area.
4. Have students design a shelter for their own home and list the provisions needed.
5. Appoint a committee to investigate the emergency plan for your school. What emergencies are planned for and are these plans adequate? Evaluate the findings and make recommendations to the appropriate officials if needed.

LEARNING OBJECTIVE

The student will gather, organize, and interpret information about the functions and responsibilities of national, state, and local Emergency Management organizations.

ACTIVITIES

1. Divide the class into groups and have each research one organization concerned with emergency management. Include the functions and responsibilities of national, state, and local government agencies as well as private groups such as the American Red Cross. The students can use various methods of presenting the information such as oral and written reports, panel discussions, role-playing exercises, maps, charts, and graphic displays. In class discussion, list and categorize the various organizations important to disaster readiness and emphasize the necessity for cooperation among the groups involved.

2. Invite a representative from your local Emergency Management office to discuss emergency plans in your community and the responsibilities of local authorities and volunteer organizations. In the local plan, what emergencies and disasters are planned for and why are these included?
3. Arrange for the class to visit the nearest National Weather Station. Discuss the role of the National Weather Service in the predicting, warning, and tracking of weather-related disasters. Ask the representative to explain the operation of NOAA Weather Radio.

LEARNING OBJECTIVE

The student will identify the ALERTING and WARNING signals for a pending disaster and explain the proper responses to these signals.

ACTIVITIES

1. Demonstrate in class the emergency ALERTING and WARNING signals used in your community and school. Have students prepare guides for the appropriate responses to these warnings. If possible, distribute these guides in the community.
2. Appoint a committee of students to survey the community for the locations of disaster and fallout shelters. Prepare a map indicating these shelters and the routes to them. Explain the differences between fallout shelters and disaster shelters.
3. Prepare a bulletin board or posters for the school describing the procedures to be followed should a disaster or emergency occur during school hours.

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Nash, Jay Robert. *Darkest Hours.* Chicago: Nelson-Hall, 1976.

Singhad, Ramesh P. *How to Save Your Life and Home from Natural Disasters.* New York: Pagurian Press Limited, 1977.

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In Time of Emergency: A Citizen's Handbook on Nuclear Attack and Natural Disasters. Federal Emergency Management Agency. H-14, reprinted 1980.

Reorganization Plan No. 3 of 1978 (Emergency Preparedness). U.S. Congress. House. Report No. 95-1523. 95th Congress, 2d session, 1978.

Reorganization Plan No. 3 of 1978, Establishing a New Independent Agency, The Federal Emergency Management Agency. U.S. Congress. Senate. Report No. 95-1141. 95th Congress, 2d session, 1978.

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FILMS AND FILMSTRIPS

Day of the Killer Tornadoes. Federal Emergency Management Agency. DDCP 20-294, 16mm film, 14½ minutes, color, 1978.
Dramatic footage of 147 deadly twisters which swept through the South and Midwest in less than 24 hours.

A Lady Called Camille. Federal Emergency Management Agency. DDCP 20-274, 16mm film, color, 27 minutes, 1971.
The story of the warnings, evacuation and rescue operations for a devastating hurricane.

Natural Disasters and What to Do. McGraw-Hill. Four sound filmstrips, color, 14 minutes each, 1976.
Series includes a filmstrip on earthquakes, floods, hurricanes and tornadoes. Each filmstrip describes the causes and effects of the disaster and the procedures which will minimize danger.

DISASTER CROSSWORD PUZZLE

Use at least 20 of the following terms to create a crossword puzzle. Write the clues.

1. Alert
2. Blizzard
3. Bomb
4. Crisis
5. Disaster
6. Earthquake
7. Ecology
8. Emergency
9. Emergency Management
10. Evacuation
11. Fallout
12. Fire
13. Flood
14. Food
15. Hurricane
16. Lightning
17. Nuclear
18. Police
19. Radiation
20. Radio
21. Seismic
22. Shelter
23. Shock
24. Storm
25. Survive
26. Tornado
27. Tsunami
28. Volcano
29. WARNING
30. WATCH

GUIDE FOR FAMILY EMERGENCY PLANNING

HOME SHELTER CHECKLIST

Location in Home:

Storm Shelter	Fallout Shelter

SUPPLIES AND STOCKS

_____ water

_____ food

_____ sanitation items

_____ first aid and health items

_____ medicines

_____ bedding

_____ cooking and eating utensils

_____ clothing

_____ toiletries

_____ fire-fighting equipment

_____ battery-powered radio

_____ flashlight

_____ batteries

_____ books, magazines, games

PUBLIC SHELTER CHECKLIST

PUBLIC SHELTER	LOCATION	ROUTE
Nearest Home		
Nearest Work		
Nearest School		

SUPPLIES TO TAKE TO SHELTER

_____ medicines

_____ food

_____ potable liquids

_____ blankets

_____ battery-powered radio

_____ flashlight

_____ toiletries

HURRICANE

Described as the "greatest storm on earth," hurricanes kill more people and destroy more property than any other kind of storm. A hurricane has wind speeds of 119 kilometers (74 miles) per hour or greater blowing around a relatively calm center - the eye. Most of the hurricane's destruction is caused by the storm surge, high winds, and flood-producing rains.

In the United States, hurricanes originate over the Tropical Atlantic Ocean, Caribbean Sea, or the Gulf of Mexico. At the National Weather Service's Hurricane Center in Miami, forecasters monitor the development of hurricanes, name them when winds reach 63 kilometers (39 miles) per hour, track their unpredictable paths, and issue advisories, WATCHES and WARNINGS.

Hurricanes are large storms, sometimes stretching over 483 kilometers (300 miles). We cannot control them, but with ample warning and safety precautions lives can be saved.

SAFETY RULES FOR HURRICANE WATCH

1. Listen for official weather bulletins on radio and television.
2. Fuel car.
3. Secure small craft or move it to safety.
4. Stock canned and non-perishable foods.
5. Store safe water.
6. Check medical supplies.
7. Check batteries for radio and flashlight.
8. Board up windows.
9. Secure outside items.
10. Be prepared to take action if WATCH changes to WARNING.

SAFETY RULES FOR HURRICANE WARNING

1. Listen for official bulletins on radio or television. If on high ground and building is sturdy, stay inside and:
   - Move valuables to upper floor.
   - Bring pets inside.
   - Fill containers with several days' supply of drinking water.
   - Stay indoors on the downwind side of house away from windows.
   - Beware of the deceiving calm winds of the eye.
2. If on low ground which might be affected by storm tide or stream flooding:
   - Evacuate early.
   - Shut off water and electricity.
   - Lock house.
   - Drive carefully to designated shelter; use recommended evacuation routes.
3. Leave mobile homes.

DEFINITIONS

Hurricane - a tropical cyclone in which winds reach speeds of 119 kilometers (74 miles) per hour or greater and blow in a large spiral around a relatively calm center - the eye.

Hurricane Eye - the relatively calm area near the center of the storm with light winds and clouds and warm temperatures. The eye is bordered by maximum winds and torrential rains.

Hurricane Season - the portion of the year having a relatively high incidence of hurricanes. In the Atlantic, Caribbean, and Gulf of Mexico, it is usually the period from June through November.

Hurricane WARNING - issued when hurricane conditions are expected in a specified area within 24 hours.

Hurricane WATCH - issued when a hurricane may threaten an area within 24 to 36 hours.

Storm Surge - a great dome of water often 80 kilometers (50 miles) wide that sweeps across the coastline near the area where the eye of the hurricane makes landfall. The surge is the most dangerous part of a hurricane.

Tropical Depression - a storm in which the maximum sustained surface wind is 33 knots (38 miles per hour) or less.

Tropical Storm - a storm in which the maximum sustained surface wind is 34-63 knots (39-73 miles per hour).

LEARNING OBJECTIVE

The student will describe the characteristics of hurricanes and explain the weather conditions which produce these storms.

ACTIVITIES

1. Select several students to investigate hurricanes. In a panel discussion or in oral reports the students should present their findings to the class and explain why the hurricane has been called the "greatest storm on earth."
2. Show a film on hurricanes. Discuss with the class the causes of the storm, its behavior, the devastating effects, and the recovery efforts.
3. List the major hurricanes of this century. Plot the paths of these storms on a map and discuss the following:

   - Which geographic areas are most vulnerable to hurricanes? Review the hurricane zone of the United States
   - In which season or seasons do these storms occur?
   - Are the paths of hurricanes predictable? Why or why not?

4. Prepare a bulletin board display on tropical storms. Illustrate the geographic areas in which hurricanes, typhoons, and cyclones occur and the life cycle of a typical hurricane.

LEARNING OBJECTIVE

The student will identify and define terms related to hurricanes.

ACTIVITIES

1. After reviewing the following terms with the class, have each student write definitions for each:

   cyclone
   eye
   hurricane
   hurricane WARNING
   hurricane WATCH
   small craft warning
   storm surge
   tropical depression
   tropical storm
   typhoon
   weather advisory
   weather bulletin

2. Have students write original stories or skits describing a hurricane.

LEARNING OBJECTIVE

The student will explain the importance of hurricane forecasting.

ACTIVITIES

1. Arrange for the class to visit the nearest weather station to observe the methods used in predicting the weather. Discuss with a meteorologist the elements of weather which produce hurricanes, the hurricane warning system, and how the information is communicated.
2. Construct and demonstrate simple models of instruments used in weather prediction (Activity Sheets H-1 and H-2). Explain how these would function before, during, and after a hurricane.
3. Have students describe what weather conditions exist for a hurricane WATCH and WARNING to be issued. Who issues these alerting signals and how?
4. Review the procedure used by the National Weather Service in tracking hurricanes. Using the simulated advisories and the hurricane tracking chart, track Hurricane Cora (Activity Sheets H-3, H-3a;   ).

   NOTE: On the 24-hour clock, 0001 hours is one minute past midnight, 0600 hours is 6:00 A.M., 1200 hours is noon, 1800 hours is 6:00 P.M., 2400 hours is midnight.

LEARNING OBJECTIVE

The student will describe the destructive effects of hurricanes and the related safety precautions and responses needed.

ACTIVITIES

1. Discuss with the class the destruction caused by a hurricane's storm surge, flood, and wind. Which of these causes the most damage to life and property, and why?
2. If your area is subject to hurricanes, have students prepare a leaflet describing safety rules to be followed before, during, and after the hurricane. Distribute these in the community.
3. Tape record interviews of local residents who have experienced hurricanes. Using these tapes write and produce a radio program on hurricanes.
4. Have a student research newspapers and magazines and report on Hurricanes Agnes (June 1972), David (August 1979), Frederic (September 1979), and Allen (August 1980). What was the extent of damage and destruction caused by these ferocious storms?
5. Discuss with the class emergency food and water requirements. Have each student write a brief explanation of how his or her family is prepared for a hurricane and what measures they would take to ensure a safe and sufficient supply of food and water.
6. If your area is subject to hurricane damage, appoint a committee to consult with the local Emergency Management Coordinator on hurricane preparedness plans for your area. Report to the class on local plans and plot the evacuation routes and shelters on a map.

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BOOKS

Allen, Everett S. *A Wind to Shake the World: The Story of the 1930 Hurricane.* Boston: Little, Brown and Company, 1976.

Brindze, Ruth. *Hurricanes: Monster Storms from the Sea* New York: Antheneum Publishers, 1973.

Brown, Billye W. and Walter R. *Historical Catastrophes: Hurricanes and Tornadoes.* Reading, Ma: Addison-Wesley, 1972.

Jenning, Gary. *The Killer Storms: Hurricanes, Typhoons and Tornadoes.* New York: J. B. Lippincott Company, 1970.

PAMPHLETS

Hurricane: The Greatest Storm on Earth. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA/PA 76008, 1977.

Some Devastating North Atlantic Hurricanes of the 20th Century. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA/PA 77019, rev. 1977.

Storm Surge and Hurricane Safety: With North Atlantic Tracking Chart. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA/PA 78019, 1979.

The Homeport Story: An Imaginary City Gets Ready for a Hurricane. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA/PA 70028.

FILMS AND FILMSTRIPS

A Lady Called Camille. Federal Emergency Management Agency. DDCP 20-274. 16mm film, color, 27 minutes, 1971.
The dramatic story of the warnings, evacuation and rescue operations for a devastating hurricane.

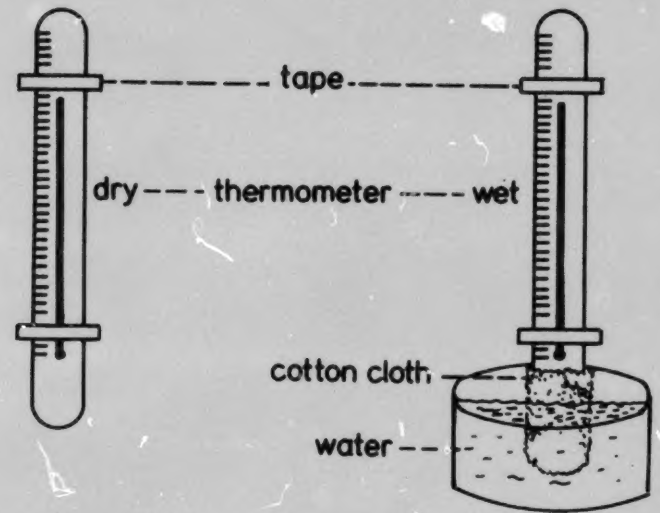
Forecasting the Weather. National Geographic Society. Sound filmstrip, color, 14 minutes, 1979.
Describes the elements of weather, weather forecasting, and the tracking of severe storms, including hurricanes.

Hurricanes. McGraw-Hill. From series *Natural Disasters and What to Do.* Sound filmstrip, color, 14 minutes, 1976.
Describes causes and effects of nurricanes and related safety procedures. Good diagrams and charts.

Storm. Federal Emergency Management Agency. DDCP 20-284. 16mm film, color, 28½ minutes, 1974.
Tells the story of the disastrous flooding that resulted from Hurricane Agnes.

Storms: The Restless Atmosphere. Encyclopedia Britannica Education Corporation. From the AGI/EBE Earth Science Program.

Wet and Dry Bulb Thermometer
(Hygrometer)

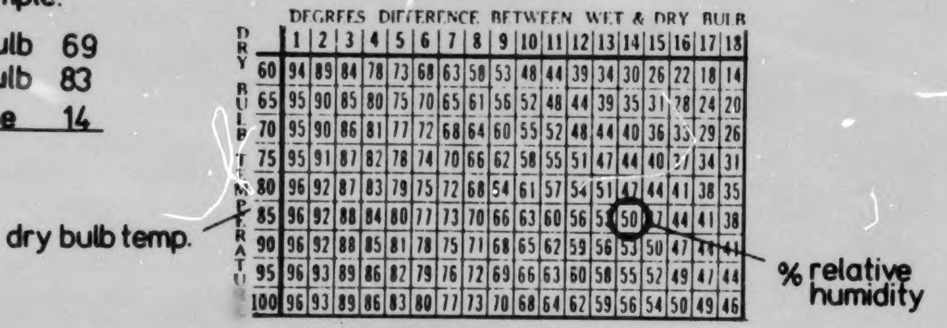


PURPOSE: To measure relative humidity.

PROCEDURE: Allow the wet bulb thermometer to drop in temperature and to stabilize. Read and record both dry and wet bulb temperatures. Subtract the wet bulb temperature from the dry bulb temperature and record.

example:

wet bulb	69
dry bulb	83
difference	14

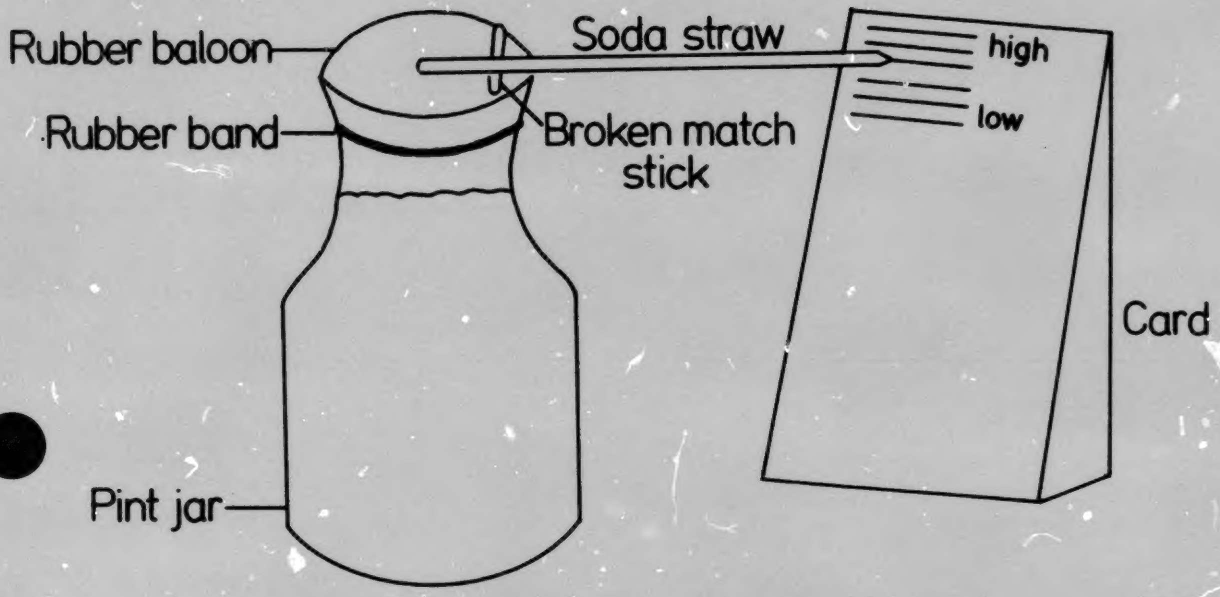

dry bulb temp.
% relative humidity

DRY BULB TEMPERATURE	DEGREES DIFFERENCE BETWEEN WET & DRY BULB 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
60	94	89	84	78	73	68	63	58	53	48	44	39	34	30	26	22	18	14
65	95	90	85	80	75	70	65	61	56	52	48	44	39	35	31	28	24	20
70	95	90	86	81	77	72	68	64	60	55	52	48	44	40	36	33	29	26
75	95	91	87	82	78	74	70	66	62	58	55	51	47	44	40	37	34	31
80	96	92	87	83	79	75	72	68	54	61	57	54	51	47	44	41	38	35
85	96	92	88	84	80	77	73	70	66	63	60	56	53	50	47	44	41	38
90	96	92	88	85	81	78	75	71	68	65	62	59	56	53	50	47	44	41
95	96	93	89	86	82	79	76	72	69	66	63	60	58	55	52	49	47	44
100	96	93	89	86	83	80	77	73	70	68	64	62	59	56	54	50	49	46

Relative humidity table

TO READ THE CHART: Find at the extreme left of the chart the temperature to the nearest 5° equal to the dry bulb temperature. Follow this line of figures across to the column under the figure in the top row equal to the difference between the wet and dry bulb temperatures. In this box is the relative humidity in percent.

ANEROID BAROMETER



PURPOSE: To measure atmospheric pressure.

PROCEDURE: 1) Stretch a rubber sheet (balloon) over the rim of a clean and empty pint jar. 2) Secure sheet with a rubber band. 3) Paste a broken matchstick near the edge of the sheet. 4) Use paste or glue to attach the straw as shown above. 5) Set up a card to one side of the jar. The straw should touch the card. 6) Mark the card where the straw touches.

TO READ THE BAROMETER: Listen to the weather forecast or read a daily newspaper to obtain the correct pressure system for the area on a specific day. Label the mark you have already made either "high" or "low" according to your information. For example, if the pressure is "low" for the day and the next day higher on the card, the pressure has risen and is called "high."

EXTRACTS FROM SIMULATED HURRICANE ADVISORIES

Extract No. 1

NATIONAL HURRICANE CENTER HURRICANE ADVISORY NUMBER 5 CORA NOON EDT SATURDAY AUGUST 23 1980.

AT NOON ... 1600Z ... THE CENTER OF HURRICANE CORA WAS ESTIMATED ABOUT 300 MILES EAST OF THE LEEWARD ISLANDS OR NEAR LATITUDE 17 NORTH LONGITUDE 56 WEST. HOWEVER AT THAT TIME THE FORWARD EDGE OF THE DANGEROUS WINDS WAS ONLY 200 MILES EAST OF THE ISLAND OF ANTIGUA. THE STORM IS MOVING TOWARD THE NORTHWEST AT ABOUT 20 MPH. LITTLE CHANGE IN THE SPEED AND DIRECTION IS EXPECTED DURING THE NEXT 12 HOURS.

MAXIMUM SUSTAINED WINDS ARE ESTIMATED AT 125 MPH BRIEFLY HIGHER IN GUSTS NEAR THE CENTER WITH HURRICANE FORCE WINDS EXTENDING OUTWARD 60 MILES TO THE NORTH AND WEST AND 30 MILES TO THE EAST AND SOUTH. GALE FORCE WINDS EXTEND OUTWARD 125 MILES FROM THE CENTER. THE STORM IS EXPECTED TO DECREASE IN INTENSITY DURING THE NEXT 12 HOURS. THE LOWEST PRESSURE IN THIS SEVERE HURRICANE IS 955 MBS OR 28.20 INCHES.

REPEATING THE NOON POSITION ... LATITUDE 17 NORTH LONGITUDE 56 WEST.

Extract No. 2

NATIONAL HURRICANE CENTER HURRICANE ADVISORY NUMBER 14 CORA 6 PM EDT MONDAY AUGUST 25 1980.

AT 6 PM ... 2200Z ... THE CENTER OF HURRICANE CORA WAS ESTIMATED ABOUT 300 MILES EAST OF THE BAHAMA ISLANDS OR NEAR LATITUDE 26 NORTH LONGITUDE 71 WEST. AT THAT TIME THE FORWARD EDGE OF THE DANGEROUS WINDS WAS ONLY 180 MILES EAST OF CAT ISLAND. THE STORM CONTINUES TO MOVE TOWARD THE NORTHWEST AT ABOUT 20 MPH. THE STORM IS EXPECTED TO CONTINUE TO THE NORTHWEST WITH INCREASED SPEED OF 25 MPH DURING THE NEXT 12 HOURS.

MAXIMUM SUSTAINED WINDS ARE ESTIMATED AT 150 MPH BRIEFLY HIGHER IN GUSTS NEAR THE CENTER WITH HURRICANE FORCE WINDS EXTENDING OUTWARD 50 MILES TO THE NORTH AND WEST AND 25 MILES TO THE EAST AND SOUTH. GALE WINDS EXTEND OUTWARD 120 MILES FROM THE CENTER. THE STORM IS EXPECTED TO INCREASE IN INTENSITY DURING THE NEXT 12 HOURS. THE CENTRAL PRESSURE CONTINUES STEADY AT 27.85 INCHES.

REPEATING THE 6 PM POSITION ... LATITUDE 26 NORTH LONGITUDE 71 WEST.

Extract No. 3

NATIONAL HURRICANE CENTER HURRICANE ADVISORY NUMBER 18 CORA NOON EDT TUESDAY AUGUST 26 1980.

AT NOON ... 1600Z ... THE CENTER OF HURRICANE CORA WAS ESTIMATED ABOUT 175 MILES SOUTHEAST OF WILMINGTON NORTH CAROLINA AND 200 MILES EAST OF CHARLESTON SOUTH CAROLINA OR NEAR LATITUDE 32 NORTH LONGITUDE 76 WEST. THE FORWARD EDGE OF THE DANGEROUS WINDS WAS ONLY 75 MILES SOUTHEAST OF WILMINGTON. THE STORM CONTINUES TO MOVE TOWARD THE NORTHEAST AT ABOUT 10 MILES PER HOUR. LITTLE CHANGE IN SPEED AND DIRECTION IS EXPECTED DURING THE NEXT 12 HOURS.

MAXIMUM SUSTAINED WINDS ARE ESTIMATED AT 125 MPH BRIEFLY HIGHER IN GUSTS NEAR THE CENTER WITH HURRICANE FORCE WINDS EXTENDING OUTWARD 100 MILES NORTH AND WEST AND 75 MILES TO THE EAST AND SOUTH. GALE FORCE WINDS EXTEND OUTWARD 125 MILES FROM THE CENTER. THE STORM IS EXPECTED TO DECREASE IN INTENSITY DURING THE NEXT 12 HOURS. THE CENTRAL PRESSURE CONTINUES STEADY AT 28.00 INCHES.

REPEATING THE NOON POSITION ... LATITUDE 32 NORTH LONGITUDE 76 WEST.

HOW TO TRACK A HURRICANE

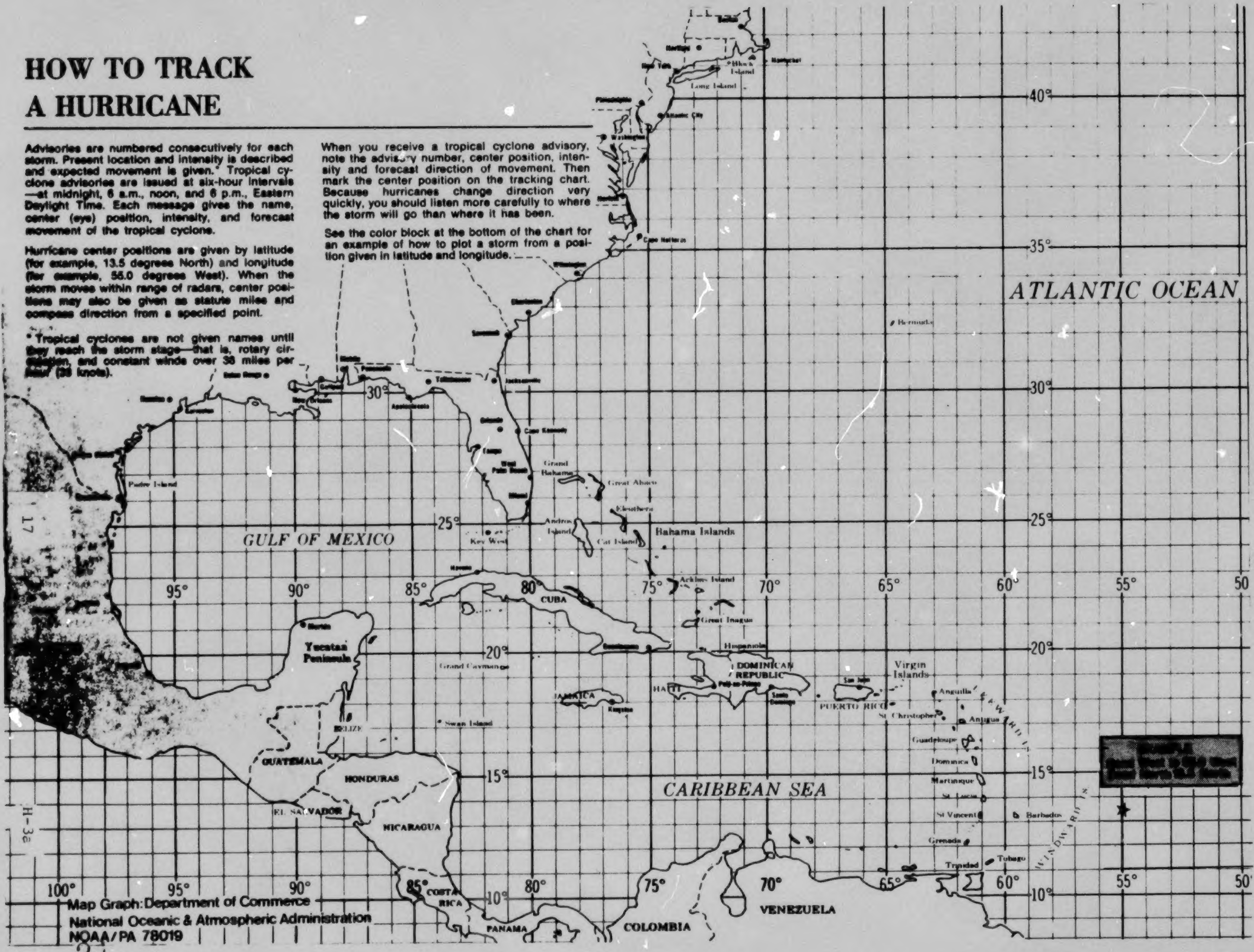
Advisories are numbered consecutively for each storm. Present location and intensity is described and expected movement is given.* Tropical cyclone advisories are issued at six-hour intervals —at midnight, 6 a.m., noon, and 6 p.m., Eastern Daylight Time. Each message gives the name, center (eye) position, intensity, and forecast movement of the tropical cyclone.

Hurricane center positions are given by latitude (for example, 13.5 degrees North) and longitude (for example, 55.0 degrees West). When the storm moves within range of radars, center positions may also be given as statute miles and compass direction from a specified point.

When you receive a tropical cyclone advisory, note the advisory number, center position, intensity and forecast direction of movement. Then mark the center position on the tracking chart. Because hurricanes change direction very quickly, you should listen more carefully to where the storm will go than where it has been.

See the color block at the bottom of the chart for an example of how to plot a storm from a position given in latitude and longitude.

* Tropical cyclones are not given names until they reach the storm stage—that is, rotary circulation, and constant winds over 38 miles per hour (33 knots).



ATLANTIC OCEAN
GULF OF MEXICO
CARIBBEAN SEA
40°
35°
30°
25°
20°
15°
10°
100°
95°
90°
85°
80°
75°
70°
65°
60°
55°
50°
Long Island
Block Island
Cape Hatteras
Bermuda
Padre Island
Key West
Grand Bahama
Great Abaco
Eleuthera
Andros Island
Cat Island
Bahama Islands
Acklins Island
Great Inagua
CUBA
Yucatan Peninsula
Grand Cayman
Swan Island
JAMAICA
HAITI
Hispaniola
DOMINICAN REPUBLIC
PUERTO RICO
Virgin Islands
Anguilla
St. Christopher
Antigua
Guadeloupe
Dominica
Martinique
St. Lucia
St. Vincent
Barbados
Grenada
Tobago
Trinidad
LEEWARD IS.
WINDWARD IS.
BELIZE
GUATEMALA
HONDURAS
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
COLOMBIA
VENEZUELA
17
H-3a

Map Graph: Department of Commerce
National Oceanic & Atmospheric Administration
NOAA/PA 78019

FLOOD

For ages, floods have been natural and inevitable occurrences along streams and rivers. When soil and vegetation can no longer absorb falling rain or melting snow, or when more water flows down a river than the channel can carry, flooding takes place.

Some floods are periodic resulting from melting snow or seasonal rains draining down narrow tributaries and filling water basins with too much water, too quickly. Usually there is ample warning for these floods. Other floods are sudden, occurring in a flash and with little or no warning. These can result from heavy rain, icejam breakup, earthquakes, mudslide, or dam failure. Areas most susceptible to flooding include mountain valleys, floodplains, and coastal lowlands.

FLOOD SAFETY RULES

BEFORE A FLOOD THREATENS

1. Plan what you will do and where you will go in a flood emergency.
2. Have first aid supplies on hand.
3. Keep automobile fueled should evacuation become necessary.
4. Keep a stock of canned and non-perishable food on hand; store drinking water in clean containers.
5. Keep a portable radio, flashlight, and extra batteries on hand.
6. Keep portable cooking equipment in working order.
7. Listen to your radio or television for emergency instructions.
8. Move to a safe area before access is cut off by flood water.

DURING A FLOOD

1. Avoid areas subject to sudden flooding.
2. Do not attempt to cross a flooding stream where water is above the knees.
3. Do not attempt to drive over a flooded road or bridge.

AFTER A FLOOD

1. Do not use food or water that has been in contact with flood waters.
2. Do not use water from normal water supply (faucets, well, spring, cistern) until it is tested for potability. The local Health Department can assist in the water testing.
3. Do not visit a disaster area as visitors might hamper rescue and other emergency operations.
4. Do not handle live electrical equipment in wet areas.
5. Report broken utility lines to appropriate authorities.

DEFINITIONS

Dam - a barrier preventing the flow of water.

Erosion - to wear away by the action of water or wind.

Flash Flood - sudden flooding that occurs with little or no warning.

Flash Flood WARNING - issued when flash flooding is likely or is occurring. One of the most urgent types of weather warnings issued, the WARNING means immediate action should be taken. Move to safe ground immediately.

Flash Flood WATCH - issued when heavy rains may result in flash flooding. The WATCH means to keep informed and be prepared for the possibility of a flood emergency.

Flood - an overflow of water onto normally dry land.

Floodplain - a strip of land bordering a river or stream which is susceptible to flooding.

Flood WARNING - a forecast of impending flood. The warning message will give the expected degree of flooding (minor, moderate, or severe), the affected river, and when and where flooding will begin. Flood WARNINGS can be issued hours to days in advance allowing residents time to leave low-lying areas.

Potable - suitable for drinking.

Tributary - a stream which feeds into a larger stream, river, or lake.

LEARNING OBJECTIVE

The student will explain the various causes and characteristics of floods and define the related terminology.

ACTIVITIES

1. Gather newspaper and magazine reports on floods. After discussing these, have students describe the causes and characteristics of the floods.
2. Have students prepare a bulletin board display illustrating the various causes and effects of flooding.
3. Discuss the areas of severe river flooding in the United States (Media Kit). Select students to research and report on the impact of floods in these geographical areas.
4. Using the terms listed below, have students write a story of a hypothetical flood:

    dam
    erosion
    flash flood
    flood
    flood crest
    floodplain
    flood WARNING
    flood WATCH
    hydrology
    inundation
    mud flow
    tributary

5. Have students complete the Flood Wordsearch Puzzle (Activity Sheet FL-1).

LEARNING OBJECTIVE

The student will recognize that floods can be beneficial as well as destructive.

ACTIVITIES

1. Select several students to read and report on accounts of floods in history, mythology, literature, and poetry.
2. Appoint two committees to compare and contrast the beneficial and hazardous effects of flooding. The students should consider:
   - The useful effects of flooding on the ancient civilizations which developed in the fertile areas along rivers.
   - The destruction of floods.

LEARNING OBJECTIVE

The student will describe the hazards of flooding and the related precautions.

ACTIVITIES

1. Prepare a chart illustrating severe flood disasters and the damage to life and property.
2. Show a film on flooding and discuss the causes of the flood and the results. What, if any, emergency preparations and actions were described and how did these affect the impact of the flood?
3. Have students write letters or articles for the school or local newspaper explaining the flood hazards in your community. Include a list of the preparations to be taken before a flood, what citizens should do during a flood, and what would be done after the flood.
4. Obtain flood plain maps of local streams and rivers from the local planning commission or Emergency Management Coordinator. Have students locate their homes and determine the likelihood of being flooded. Encourage each student to design an emergency flood plan for his or her family.
5. Have students compile a list of safety rules for floods. Explain the proper responses to flood WATCHES and WARNINGS. If your community is subject to flooding, distribute these to local citizens.

LEARNING OBJECTIVE

The student will relate the efforts of local, state, and national governments in flood control measures and flood disasters.

ACTIVITIES

1. In a panel discussion have students report on national and state flood control measures, flood mitigation, prediction and warning programs, and types and sources of flood disaster assistance available.
2. If your community is subject to flooding, invite a local government official or Emergency Management Coordinator to discuss the plans for flood preparedness, warning, and evacuation.

3. If a dam is located near your community, arrange for the class to visit it. Have a representative of the project explain the need for and functions of this dam. How has this dam affected the area? Has it been a useful flood control measure?

REFERENCES

BOOKS

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Navarra, John Gabriel. *Nature Strikes Back.* The American Museum of Natural History, 1971.

PAMPHLETS

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The Flood that Strikes in a Flash. U.S. Department of Commerce National Oceanic and Atmospheric Administration. Reprinted from *NOAA*, Volume 2, number 3, July 1972.

Floods, Flash Floods, and Warnings. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA/PA 71009, 1973.

The Hydrologic Cycle. U.S. Department of Commerce, National Oceanic and Atmosperic Administration. NOAA/PA 71011, 1974.

FILMS AND FILMSTRIPS

Great Flood of 1973. U.S. Army Engineer District, St. Paul, Mn. 16mm film, 25 minutes, 1974.
Recounts events of the 1973 Mississippi River Flood.

Flood! U.S. Department of Commerce, National Oceanic and Atmospheric Administration. 16mm film, color, 15 minutes.
Describes how flood predictions are made and gives basic precautions against dangers and hardships of floods.

Flood. McGraw-Hill. From series *Natural Disasters and What to Do.* Sound filmstrip, color, 14 minutes, 1976.
Good explanation of safety rules for floods.

Floods. National Geographic Society. From series *Powers of Nature.* Sound filmstrip, color, 13 minutes, 1973.
Describes river floods and methods of controlling them.

FLOOD WORDSEARCH PUZZLE

A	O	F	N	O	I	T	A	T	O	R	P	O	R	C
R	N	D	G	H	J	J	D	B	A	S	K	L	R	B
G	U	L	L	Y	Y	M	K	B	E	V	P	O	B	O
M	D	F	A	B	C	G	O	C	R	Z	C	Y	I	U
D	S	E	C	K	I	B	A	P	O	K	A	B	N	L
F	T	H	I	J	L	R	C	W	S	D	M	E	O	D
H	R	G	E	G	R	F	H	L	I	I	J	K	I	E
C	I	I	R	E	L	M	I	L	O	N	N	O	S	R
N	P	P	T	Q	T	D	U	R	N	S	D	T	O	F
O	M	U	N	V	E	W	F	L	O	O	D	S	R	I
I	I	B	O	H	A	W	A	W	A	N	X	X	E	E
T	N	Y	I	Z	A	O	B	S	C	O	D	E	L	L
A	I	Z	T	F	G	L	P	G	H	Y	H	P	I	D
D	N	F	A	D	E	F	I	A	T	I	X	N	O	H
I	G	C	G	K	I	D	P	Q	X	J	N	Q	S	I
X	O	M	I	N	O	U	E	C	O	L	O	G	Y	J
O	R	W	R	U	T	M	S	R	D	W	C	R	K	S
D	X	A	R	V	G	N	I	R	E	H	T	A	E	W
E	Z	Y	I	B	Z	B	E	F	F	T	U	V	G	P
B	A	C	D	N	X	C	O	X	I	D	A	T	B	P
D	I	S	I	N	T	E	G	R	A	T	I	O	N	M
A	H	Y	X	W	V	U	T	S	E	R	Q	P	O	N
T	Z	E	X	F	O	L	I	A	T	I	O	N	Y	Z
B	A	C	D	D	E	F	F	G	H	I	J	K	L	D
O	N	L	S	T	B	L	O	C	K	F	I	E	L	D
P	G	U	U	V	I	A	H	X	G	E	F	J	B	E
F	Q	R	U	S	Q	P	D	O	R	N	C	K	L	M

Boulder field
Crop rotation
Ecology
Erosion
Floods
Glacier
Gully
Irrigation
Mud flow
Oxidation
Rain
Rockslide
Sheet washing
Soil erosion
Strip mining
Terraces
Weathering
Wind

TORNADO

The tornado is a violent storm with spiraling, high-speed winds usually rotating in a counter-clockwise direction. These funnels are composed of condensed water vapor, dust and debris and have powerfully destructive effects. Usually moving from the south, southwest, or west at speeds ranging from 50 to 60 kilometers (30-40 miles) per hour, a tornado touches down in a path, seldom more than 25 kilometers (13 miles) long and about one-half kilometer (one-fourth mile) wide.

Although known to occur in all 50 states, the tornado strikes more frequently in the Gulf Coast and Midwestern Plains of the United States. Tornadoes are most often sighted in "tornado alley," the Central Plains states where great expanses of land are flat and open. The months of greatest tornado frequency are April, May and June.

HOME SAFETY PROCEDURES

1. Develop a tornado safety plan.
2. Basements or storm cellars offer the greatest protection.
3. With no basement, take cover on the lowest floor in the center part of the house, or under sturdy furniture.
4. Stay away from windows.
5. Crouch on knees, head down, and cover head with arms (body safety position).
6. In mobile homes, leave and go to more substantial shelter.

SCHOOL SAFETY PROCEDURES

1. Know school tornado WARNING signal.
2. Accept directions from those in authority.
3. Proceed quickly and quietly to designated safe area.
4. Avoid rooms with wide, free-span roofs (auditoriums, cafeterias and gymnasiums).
5. Avoid large glassed areas.
6. Where possible avoid hallways running southwest as they often form wind tunnels.
7. Learn body safety position.

SAFETY PROCEDURES IN OPEN COUNTRY

1. If there is no time to find suitable shelter, lie face down in the nearest depression, such as a ditch or gully.
2. Protect head with arms.

DEFINITIONS

Debris - remains or fragments of something broken down or destroyed. In a tornado, fragments of buildings, trees, dirt, lumber, and pebbles can be carried by the winds.

Dust Devil - a small whirlwind containing sand or dust. Found on stretches of desert or dry fields, a dust devil contains heat but no moisture to fuel it; therefore, it cannot develop into a dangerous tornado.

Funnel - a dark, spinning rope or column of high speed winds rotating in a counter-clockwise direction.

Tornado - a violently rotating wind which appears as a funnel-shaped cloud stretching from the cloud layer to the ground. Tornadoes form several thousand feet above the earth's surface, usually during warm, humid, unsettled weather and in consort with severe thunderstorms. Most tornadoes rotate in a counter-clockwise direction and usually destroy everything in their paths.

Tornado WARNING - a tornado has been sighted in the area or indicated by radar. WARNINGS indicate the location of the tornado at the time of detection, the area through which it is expected to move, and the time period during which a tornado could occur.

Tornado WATCH - weather conditions suggest that a tornado may form in a designated area within a specified period of time.

Water Spout - a tornado which occurs over a body of water. Because it has much moisture and little heat, a water spout is less dangerous than a tornado.

LEARNING OBJECTIVE

The student will describe the characteristics of a tornado and the weather conditions which produce tornadoes.

ACTIVITIES

1. Show a film on tornadoes and discuss the following questions:
    - What weather conditions were present before and during the tornado?
    - Was the tornado destructive? If so, what were the effects?
    - Were warnings issued? What were these?
    - How did people react to the warning?
    - Did safety precautions help protect people during the tornado? What were these?
2. Have students report on the various theories on the generation of tornadoes. Discuss why scientists have been unable to agree on the actual cause of tornadoes.
3. Have students define these words related to tornadoes:

    air pressure
    counter-clockwise
    debris
    funnel
    precipitation
    rotary winds
    vacuum
    vortex
    wind velocity

4. Have students do a word study on the derivation of "tornado," and write a descriptive paragraph on this violent weather phenomenon. Ask students to relate any personal experiences they may have had with tornadoes.

5. Using local weather forecasts and maps over a period of weeks, have students determine if and when weather conditions could possibly produce tornadoes. Discuss why the late afternoon and early evening are the most likely times of day for tornadoes to occur.
6. Discuss the weather elements at work in a tornado. Have students explain the weather elements at work in a tornado (Activity Sheet T-1).
7. Read and discuss the tornado as described in *The Wizard of Oz*.

LEARNING OBJECTIVE

The student will identify the seasons and geographical areas in which tornadoes occur most frequently.

ACTIVITIES

1. Have students research the geographic areas most vulnerable to tornadoes and the season in which tornadoes are most frequent. A variety of methods can be used for presenting the information, including a bulletin board display, maps, charts, or graphs.
2. Discuss the geographical areas in which tornadoes occur most frequently (Media Kit). Where is "tornado alley?"
3. Have a student research and report on tornadoes which have occurred in your state and relate these to the seasonal and geographic patterns discovered in the preceding activities.

LEARNING OBJECTIVE

The student will learn the meaning of tornado WATCH and WARNING and explain the role of the National Weather Service in tornado prediction and tracking.

ACTIVITIES

1. Discuss tornado danger signs and have each student write a brief explanation of a tornado WATCH and WARNING.
2. Invite a representative from your local weather station to discuss tornadoes and the methods used in predicting and warning of violent storms. Ask for an explanation of Project Skywarn.

LEARNING OBJECTIVE

The student will know tornado safety rules and demonstrate appropriate reactions to a tornado emergency.

ACTIVITIES

1. Appoint a committee of students to work with the administration to organize a "Tornado Awareness Week" in your school. The following could be a part of this week's activities:

- Prepare a display for the school on the destructive nature of tornadoes and the safety rules to be followed.
- Have students design and distribute a leaflet on tornado safety rules.
- Invite a representative from the local office of Emergency Management to present a program on the dangers of tornadoes and the related safety measures.

2. Simulate a tornado emergency in your class. Students should role-play the responses to the disaster by school staff, students, individual citizens, and local officials. Some activities which could be included in this simulation are weather bulletins, warnings, precautionary actions taken, and recovery measures.

   Situation - Severe thunderstorm and tornado WARNINGS have been issued in your county; a tornado was sighted 7 miles southwest of your community.

3. Have a student write for the school newspaper an account of the tornado emergency simulation in the preceding activity.
4. Have students write and record a tornado safety message for radio or television.

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Tornado. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA/PA 77027, 1978.

Tornado Safety Rules in Schools. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA/PA 74025, rev. 1975.

FILMS AND FILMSTRIPS

Day of the Killer Tornadoes. Federal Emergency Management Agency. DDCP 20-290. 16mm film, color, 27 minutes, 1978.
Reports on the 147 deadly twisters which swept through 13 states on April 3-4, 1974.

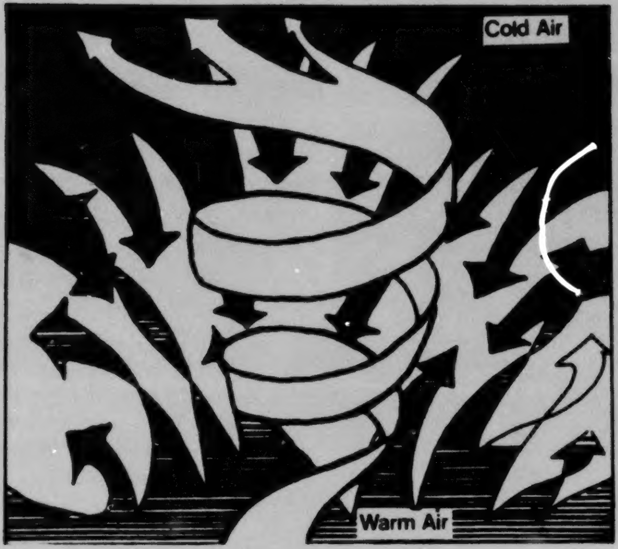
Tornado. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. 16mm film, color, 15 minutes.
Shows weather conditions which may generate a tornado. Includes scenes of a tornado in action and describes protective preparations.

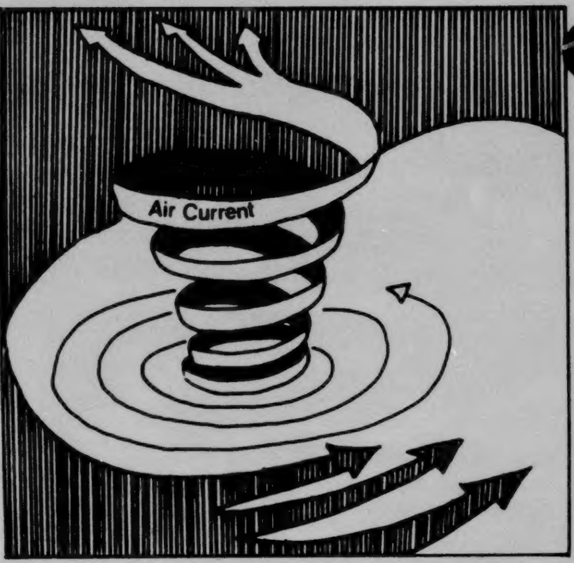
Tornado Below. National Aeronautics and Space Administration, Langley Research Center. 16mm film, 14 minutes, 1975.
Explains how tornadoes are formed, their characteristics, and the destruction they cause.

Tornadoes. McGraw-Hill. From series *Natural Disasters and What to Do*. Sound filmstrip, color, 14 minutes, 1976.
Describes the causes of a tornado, what happens when one strikes, and the safety procedures to minimize danger.

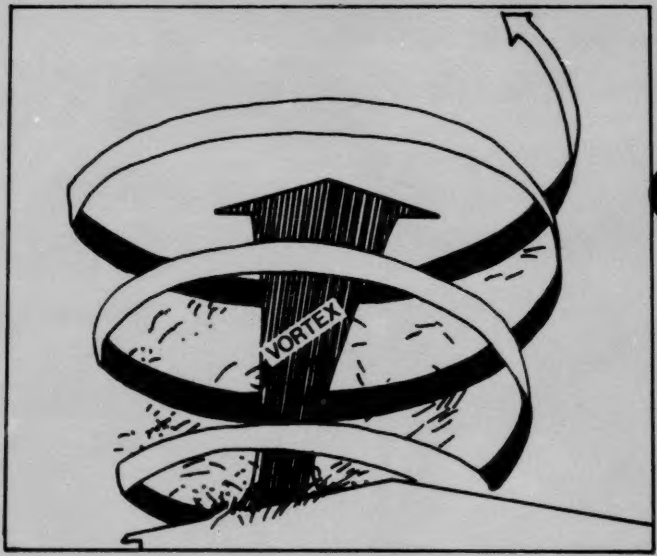
Twister. Federal Emergency Management Agency. DDCP 20-282. 16mm film, color, 27 minutes, 1973.
Tells the story of a tornado which struck Lubbock, Texas and how the city responded.

TORNADO-Nature's Most Violent Wind


Cold Air
Warm Air


Air Current

How does a tornado form and why is it destructive?



THUNDERSTORM

Thunderstorms have been called "weather factories" because they produce many dangerous and severe forms of weather. Lightning, destructive winds, heavy rain, hail, and tornadoes can all be products of a thunderstorm. It is estimated that at any given moment, nearly 2,000 thunderstorms are occurring over the earth's surface. Their frequency and potential for violence make them one of nature's great killers and destroyers. In the United States, over 200 people die each year from lightning, or from fires caused by lightning.

Thunderstorms are more frequent in the spring and summer when surface layers of warm moist air rise and collide with upper layers of cool dry air. Severe storms are created when great differences of temperature and moisture exist among the layers of air.

SAFETY RULES

IF YOU ARE INSIDE

1. Stay away from open doors and windows.
2. Stay away from fireplaces, radiators, stoves, metal pipes, sinks, and bathtubs.
3. Do not use telephone except in emergencies.
4. Unplug electrical equipment and avoid using electrical appliances.

IF YOU ARE OUTSIDE

1. Avoid being above the surrounding landscape (do not stand on a hilltop).
2. Do not stand under tall trees or telephone poles.
3. Do not use metal objects such as fishing poles or golf clubs;take off golf shoes.
4. Stay away from open water; leave swimming pools and lakes immediately.
5. Stay away from vehicles such as motorcycles, tractors, bicycles, and golf carts.
6. Stay away from wire fences, clotheslines, metal pipes, and playground equipment.
7. If in a group, stay several yards from the next person.
8. If caught in the open, the best protection is a cave, ditch, culvert, or depression in the ground.

DEFINITIONS

Cumulus - a thick, white, fluffy cloud with a flat base and rounded top.

Cumulonimbus - a dense, vertically developed cumulus cloud usually producing heavy rains, thunderstorms, or hailstorms.

Hail - precipitation in the form of lumps of ice occurring during some thunderstorms.

Lightning - a discharge of electricity that has been stored in a cloud. These discharges can occur within the cloud, from cloud to cloud, or between the cloud and ground.

Severe Thunderstorm - a thunderstorm with winds more than 95 kilometers (58 miles) per hour or hail 2 centimeters (3/4 inch) or more in diameter.

Severe Thunderstorm WARNING - issued when a severe thunderstorm has been sighted. Gives location and estimated duration.

Severe Thunderstorm WATCH - issued when weather conditions are such that a thunderstorm threat exists (usually issued for a general area only).

Thunder - the crash and rumble associated with lightning produced by the explosive expansion of air heated by a lightning stroke.

LEARNING OBJECTIVE

The student will identify the weather conditions which produce lightning and thunderstorms.

ACTIVITIES

1. Discuss thunderstorms, the most common form of severe weather. Explain the elements of weather in thunderstorms and the characteristics of these storms. Relate the following terms to thunderstorm activity:

   condensation
   convection
   cumulus
   cumulonimbus
   electrification
   evaporation
   hail
   squall line
   thunder
   updraft

2. Students should explain the difference between a severe thunderstorm WATCH and WARNING.
3. Lightning has always been a mystery to man. Have students compare modern man's explanation of thunder and lightning with those represented in mythology.
4. Have students describe the various forms of lightning. If possible, take photographs of lightning from a safe place.

LEARNING OBJECTIVE

The student will relate the dangers of thunderstorms to life and property.

ACTIVITIES

1. Select students to research and report on the thunderstorms in your area. How frequently do they occur? In which seasons do they most often happen? What has been the extent of damage to people and property?

2. Have students write stories, essays, or poems describing their impressions and experiences in thunderstorms.
3. A friend is going camping in the mountains. There is a possibility of thunderstorms. Write a one-page paper in which you advise the friend of the dangers of thunderstorms, lightning, and flash floods.

LEARNING OBJECTIVE

The student will explain the safety precautions and protective measures for thunderstorms.

ACTIVITIES

1. Divide the class into groups to report on the following:
   - The sequence of events in a typical thunderstorm and the weather elements involved.
   - The dangers of lightning and thunderstorms.
   - The safety precautions to be taken when a thunderstorm threatens.
2. In writing exercises have students describe a hypothetical thunderstorm resulting in a blackout in the community. Explain how individuals and local authorities would respond to the emergencies created by the thunderstorm and power outage.
3. Throughout the school, display student-made posters illustrating the hazards of thunderstorms and the safety rules to follow when they threaten.

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Thunderstorms. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA/PA 75009, 1977.

WINTER STORM

Over many areas of the world, snow covers the ground in winter. This provides a blanket and water supply for plants and animals, and offers visual beauty and a winter playground for people. The beauty of snow, however, is deceiving, for it can be a dangerous and destructive force in nature.

Winter storms, like many thunderstorms of summer, are generated by disturbances along the boundary between cold polar and warm tropical air masses. With heavy snow, ice, extreme cold, high winds, and blizzards, winter storms immobilize large areas, damage property, and isolate or kill people and livestock.

SAFETY RULES

BEFORE A WINTER STORM

1. Keep informed of developing weather conditions through area weather bulletins and prepare for isolation at home.
2. Maintain adequate supply of heating fuel; know how to use emergency heating equipment safely.
3. Stock extra food and water as well as emergency cooking equipment.
4. Have a portable radio, flashlight, and extra batteries on hand.
5. Winterize car before storm season. Maintain a full tank of gasoline to keep water out of the tank.
6. Move animals and livestock to sheltered areas and have extra feed available before storm arrives.

DURING A WINTER STORM

1. Be alert to fire hazards created by overheated coal or oil burning stoves, fireplaces, heaters, or furnaces; keep fire-fighting equipment and extinguishers on hand.
2. Remain indoors during storms. If you must go out, avoid overexertion.
3. Dress warmly with several layers of loose-fitting, lightweight clothing. Outer clothing should be water repellent and hooded. Mittens are better than fingered gloves. Cover the mouth to protect the lungs from extreme cold air.
4. Avoid iced-over lakes and ponds.
5. Travel only if necessary. If stranded while traveling, stay in your vehicle, but keep it ventilated. Watch for rescuers, exercise lightly, and turn on dome light at night. Above all, do not panic.

DEFINITIONS

Blizzard - a long severe snowstorm with intensely strong, cold winds filled with snow.

Blizzard WARNING - considerable falling and blowing snow and winds of 56 kilometers (35 miles) per hour or greater expected to last for several hours.

Cold Wave - a rapid fall in temperature within a 24-hour period that will require emergency protective action.

Freezing Rain - rain that is likely to freeze as soon as it strikes the ground or other surfaces. If a heavy layer of ice is expected to accumulate, an ice storm is forecast.

Frostbite - the freezing or partial freezing of some part of the body.

Heavy Snow WARNING - a snowfall of at least 10 centimeters (4 inches) in 12 hours or 15 centimeters (6 inches) in 24 hours is expected.

Hypothermia - subnormal body temperature; a condition caused by the loss of body heat.

Ice Storm WARNING - a significant, possibly damaging ice accumulation is expected.

Severe Blizzard WARNING - considerable falling and blowing snow, winds of at least 72 kilometers (45 miles) per hour, and temperatures of -12.2°C (10°F) or lower are expected for several hours.

Sleet - frozen rain drops which bounce when hitting the ground and other objects. An accumulation of sleet can cause hazardous driving conditions.

Travelers' Advisory - issued to indicate that falling, blowing, or drifting snow, freezing rain or drizzle, sleet, or strong winds make driving hazardous.

Wind Chill - the combined effects of wind and temperature as equivalent to still air temperatures. The wind chill index describes the cooling power of the air on exposed flesh.

Winter Storm - hazardous winter weather frequently accompanied by ice, heavy snow, blizzards, or extreme cold.

Winter Storm WARNING - severe winter weather conditions are imminent; immediate action should be taken to protect life and property.

Winter Storm WATCH - severe winter weather conditions may affect your area.

LEARNING OBJECTIVE

The student will identify winter storm weather conditions.

ACTIVITIES

1. Discuss with the class the different types of winter storms and indicate on a map the regions in which these storms occur most frequently. Identify the types of winter storms most likely to occur in your area, and have students relate any personal experiences with these storms.
2. Select students to research and report on the causes of winter storms and the effects on individuals, businesses, and agriculture.

3. After reading fictional and true accounts of winter storms, students should describe, in their own words, human reaction to extreme cold and winter storm emergencies.
4. Assign students to create a collage, mural, or scrapbook illustrating the beauty and the hazards of severe winter weather.
5. Have students practice conversion of fahrenheit and celsius temperature readings.

Formulas:

^{o}F to ^{o}C : $(^{o}F - 32^{o}) \times \frac{5}{9} = {}^{o}C$

^{o}C to ^{o}F : $(\frac{9}{5} \times {}^{o}C) + 32^{o} = {}^{o}F$

During the winter months, keep a daily record of high and low temperature readings in your area. Which readings would indicate severe winter weather.

LEARNING OBJECTIVE

The student will understand the meaning of winter storm WATCH, WARNING, and other terms used in winter storm forecasts.

ACTIVITIES

1. Students will define winter storm WATCH and WARNING and simulate weather forecasts and public safety messages for responding to hazardous winter weather.
2. Using newspaper weather maps and forecasts, have students determine weather factors and frontal movements which produce winter storms. Explain the following winter storm conditions and warnings:

    blizzard
    drifting snow
    freezing rain
    glaze
    ice storm
    polar air
    sleet
    snow
    snow flurries
    snow squalls
    stockmen's advisories
    travelers' advisories
    wind-chill factor

3. Have students complete the Winter Weather Wordsearch Puzzle (Activity Sheet WS-1). Using the words identified, write a brief story about winter storms.
4. Have a student report to the class on the wind-chill factor and the associated dangers of hypothermia and frostbite. The National Weather Service has wind-chill charts and formulas available for the study of the wind-chill factor.
5. After the class has read Jack London's story *"To Build a Fire,"* discuss the problems of survival in extreme cold. In the story, what precautions and actions should have been taken in order to improve the chance of survival?

LEARNING OBJECTIVE

The student will describe the hazards of winter storms and know the preparations and measures needed for responding to these emergencies.

ACTIVITIES

1. Have students prepare winter storm safety rules and emergency measures for the home and for the traveler. If your school is in an agricultural area, prepare safety rules for the farm also.
2. Simulate a winter storm emergency in your class. Have the students write a script and role-play the actions of weather personnel, community officials, and individuals before, during, and following the emergency. When the students have completed the exercise, conduct a follow-up discussion on the protective and recovery measures simulated.

   Situation: The National Weather Service has issued a severe winter storm WARNING in your area. All across the state the storm has left people stranded, and has caused power outages, hazardous road conditions, burst water pipes, and broken telephone lines. In some cases buildings have collapsed under the weight of the ice. The storm is predicted to last about 12 hours with ice accumulations up to five or six inches.
3. Select students to research and report on the survival techniques of people who inhabit cold weather regions (e.g. Icelanders, Eskimos, Lapps).

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WINTER WEATHER WORDSEARCH PUZZLE

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B X O E D J K A C G L A Z E P R
V I I E V A W D L O C B T Q S E
I E O T V U R I T A G I O L X Y
S C A E P F L Y N T B E A T H I
I K N S J A D I W T L A S F W O
B S S I E B U E S H E E T R A S
I T H D Q I T O I S V R T E C J
L J E R O L R V F U O P I E I O
I U L V K F L R J L O S H Z F E
T A T E A J A G U S M O A I E Y
Y H E M O N O T V L W T V N O D
R I R A A Z T A Z L F I A G I U
E E W G N E B E E I E N P K U O
P B B R S I F G R H C F C E S L
P O I K P Q J D N C D O Q N A C
I E A X M A W L S I N P D R C U
L C H W C O I U R X I Y S R J T
S A T S N O W P L O W K O P O V
G I B S A R T Y A P Z E S T A I
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Chills
Cloudy
Cold Wave
Flurries
Freezing
Frostbite
Glaze
Permafrost
Salt
Sheet

Skiing
Shelter
Slippery
Slush
Snowdrift
Snow plow
Visability
Wind
Winterized
Winter

HEAT WAVE

The heat of summer can be a killer. An average of 175 Americans die from excessive heat each year. In many other cases, heat is the underlying cause of death. Of all natural disasters in North America, only the severe cold of winter - not lightning, hurricanes, tornadoes, or floods - takes a higher toll.

Mammals are homoiotherms, warm-blooded creatures who must maintain an essentially constant body temperature. The human body dissipates heat by varying the rate and depth of blood circulation and by losing water through the skin and sweat glands. As the environmental temperature approaches the normal body temperature, the body loses the ability to get rid of heat through the circulatory system. At this point the evaporation of sweat becomes virtually the only means of maintaining a constant temperature. When the thermal limits are exceeded by very much or for very long, a warm-blooded organism dies.

Two factors contribute to the hazards of heat wave. Under conditions of high temperatures (32°C or 90°F) and high relative humidity (above 75 percent), the evaporation of water from the body is retarded. A second health problem is created by the stagnant atmospheric conditions of heat waves. Pollutants trapped in the air add to the stresses of hot weather.

SAFETY RULES

1. Maintain lower level of physical activity during extremely hot weather.
2. When your body warns you that the heat is too much, reduce your level of activity immediately and get to a cooler environment.
3. Dress for summer. Lightweight, light-colored clothing reflects heat and sunlight and helps maintain normal body temperature.
4. Eat less in order to decrease metabolic heat production and water loss.
5. Drink plenty of water or other liquids during prolonged hot weather.
6. Unless on a salt-restricted diet, increase your salt intake when involved in strenuous physical activity.
7. Avoid overexposure during the first critical two or three hot days. Acclimate yourself gradually to hot weather.
8. Vary thermal environment; try to get out of the heat a few hours each day.
9. Avoid sunburn since this condition makes loss of body heat more difficult.
10. Learn heat syndrome symptoms and associated first aid procedures.

FIRST AID FOR HEAT SYNDROME SYMPTOMS

Heat Asthenia - move to cooler area, drink plenty of fluids and if sweating is heavy and there are no dietary restrictions, take a salt tablet.

Heat Cramps - apply pressure to cramping muscles with warm, wet towels. Take three or four doses of salt solution (½ teaspoon salt dissolved in 4 fl. oz. water) at 15 minute intervals.

Heat Stroke - this is a serious emergency and medical care is urgently needed. Summon a physician or get the patient to a hospital immediately. If medical care is not immediately available, move victim into cooler, indoor environment, place in prone position and remove clothing. The primary objective is to lower body temperature, preferably by iced bath or by sponging the body with alcohol until a tolerable temperature and pulse rate are reached (about 103°F or 39°C, or a pulse rate below 110 per minute).

DEFINITIONS

Heat Asthenia - condition caused by excessively hot, humid environment and marked by easy fatigue, headache, heavy sweating, high pulse rate, shallow breathing, poor appetite, and insomnia.

Heat Cramps - painful spasms of voluntary muscles accompanied by pupil dilation, possible heavy sweating, and cold, clammy skin.

Heat Exhaustion - condition impairing the circulatory system; the symptoms are: profuse sweating, weakness, vertigo, cold, pale and clammy skin, thready pulse, low blood pressure, normal or subnormal temperature and possible vomiting.

Heat Stroke - (Sun Stroke, Heat Collapse, Thermic Fever, Heat Hyperexia) - failure of the thermoregulatory and cardiovascular systems brought on by failure of body heat dissipation. This severe condition is marked by weakness, vertigo, nausea, headache, heat cramps, mild heat exhaustion, excessive sweating which stops just before heat stroke, sharp rise in temperature, full and pounding pulse, elevated blood pressure, delirium or coma, and flushed skin which later turns ashen or purplish.

Heat Wave - a prolonged period of unusually hot weather.

Sunburn - inflammation of the skin caused by overexposure to the ultraviolet rays of the sun.

LEARNING OBJECTIVE

The student will describe the physical characteristics and dangers of a heat wave.

ACTIVITIES

1. Assign several students to research heat waves in the United States in the past century. Report on the location, intensity, and results of these and compare them to the killer heat wave of 1980.
2. Using the diagrams on Activity Sheet HW-1, explain this statement: "In summer, the jet stream can be an ill wind indeed."
3. Define homoiotherm and explain how extreme heat and humidity affect this kind of organism. In what ways does the body dissipate heat and how do extreme heat and humidity impede this?

LEARNING OBJECTIVE

The student will identify causes, symptoms, and emergency treatment for heat-related illnesses and explain related safety rules.

ACTIVITIES

1. Have a student demonstrate taking a pulse count. Compare a normal pulse rate to the rate that would occur in heat asthenia, heat exhaustion, and heat stroke.
2. List situations in which heat syndrome could be a problem (e.g. football practice, jogging, bike riding during periods of extreme heat). Have students describe the symptoms of heat syndrome and the precautions to take to avoid these.
3. Select students to write two skits comparing the heat wave of 1980 to those which came with the Dust Bowl droughts of the 1930s. Describe the physical effects of these on people and the methods used for coping with extreme heat in the 1930s and in 1980.
4. Have students prepare posters showing the causes, symptoms, and treatments for the different types of heat illnesses. Post these in the school prior to summer vacation.

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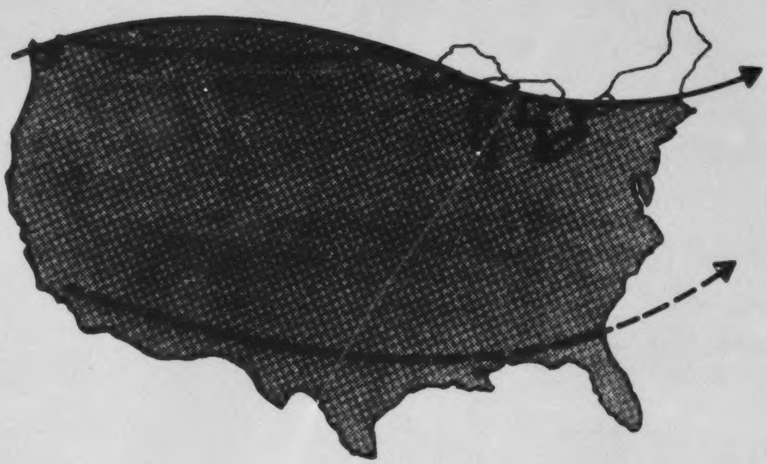
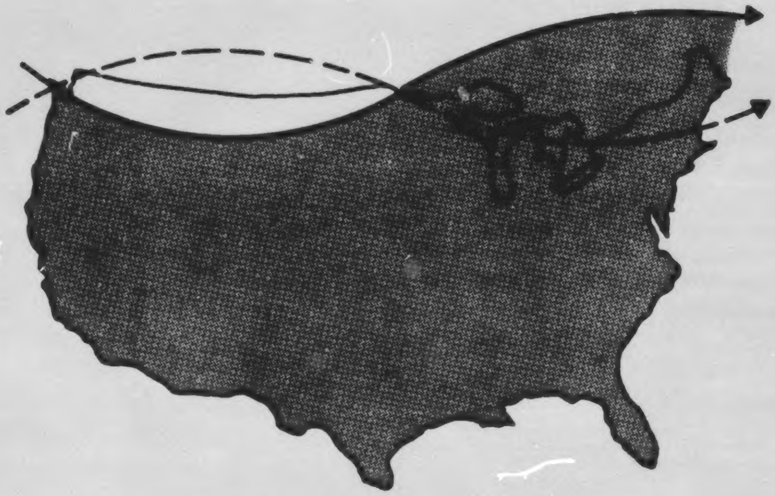
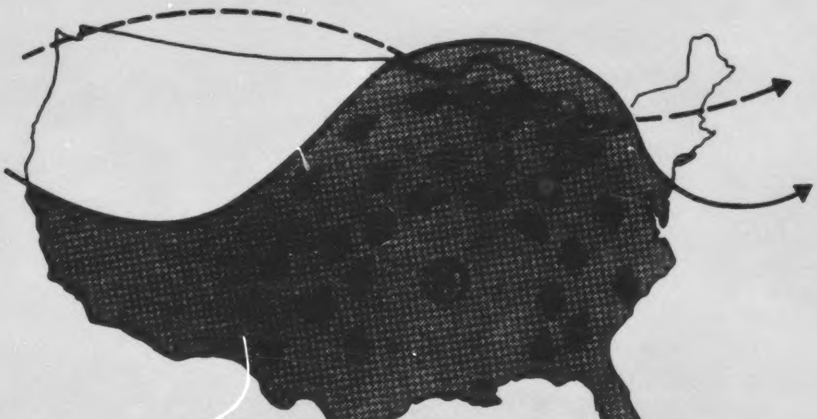
Heat Wave. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. *NOAA* Reprint. Vol. 9, Number 3, July 1979.



Normal summer position of jet stream & polar front



Displaced jet stream



Jet stream blocked northward

"In summer, the jet stream can be an ill wind indeed." Explain.

EARTHQUAKE

Earthquakes are indications that our "solid" earth is not static, but rather is in a constant state of change and evolution. A release of energy within the earth can be generated by sudden dislocations of segments of the crust, by volcanic eruptions, or even by man-made explosions. It is generally accepted that the earth's crust consists of shifting blocks or tectonic plates. Scientists have discovered that earthquakes tend to occur along faults or zones of weakness in the earth's crust; during this process, vibrations known as seismic waves are generated from the center of the quake.

In the United States earthquakes are more frequent in the western states, especially in Alaska, California, Washington, Oregon, Nevada, Utah, and Montana. However, tremors have been recorded in all fifty states. In an earthquake most injury and destruction are the result of falling objects and debris in damaged buildings. The vibrations may cause other structures such as bridges, dams, and tunnels to collapse. Often the secondary effects such as fire, landslides, tsunamis, and floods are as destructive as the earthquake itself.

When an earthquake or volcanic eruption occurs beneath the ocean floor, immense sea waves called tsunamis (from the Japanese word meaning "huge wave") are often created. Although relatively rare in the United States, tsunamis usually occur in the Pacific Ocean and can be extremely destructive.

SAFETY RULES

BEFORE AN EARTHQUAKE

An earthquake gives little or no warning; therefore, the best preparation is to know and understand what to do during and after the actual shaking. However, an awareness of the following measures could help reduce damage and loss of life:

1. In earthquake-prone areas, support safe building code regulations for public buildings and homes.
2. Support community efforts to replace weak buildings and to secure or remove loose objects on building exteriors.
3. Support school building or repair programs to insure earthquake resistant structures.
4. Support a school and community education program to prepare for future earthquakes.
5. Hold earthquake drills in public buildings and in homes; be sure that everyone is aware of basic safety precautions which should be followed in the event of a quake.

DURING AN EARTHQUAKE

1. Do not panic.
2. If indoors, go to the center of the building and take cover under sturdy furniture; stay away from glass.
3. Do not use candles, matches, or open flames since gas or fuel lines may be broken.

4. Do not venture through buildings where there is danger of falling debris.
5. If outside, stay in the open away from buildings and power lines.
6. If in a car, stop as quickly as safety permits and remain inside.
7. If in a high-rise building, get under a desk or piece of sturdy furniture and away from windows.

AFTER AN EARTHQUAKE

1. If there is an odor of gas in the building, go outside and do not re-enter until an official says it is safe.
2. If water pipes are damaged, cut off the water supply at the main valve; emergency water may be obtained from water heaters, toilet tanks, or melted ice cubes.
3. If electrical wiring is shorting out, cut off current at the main switch.
4. Stay out of damaged buildings.
5. Do not attempt to move seriously injured persons unless they are in danger of further injury.
6. Wear shoes in all areas near debris or broken glass.
7. Be prepared for earthquake aftershocks. Although most of these are less intense than the main shock, some may cause additional damage.

TSUNAMI WARNING

1. An earthquake is a natural tsunami warning. Do not stay in low-lying coastal areas after a local earthquake.
2. Since a tsunami is a series of waves, stay clear until the proper authorities indicate that it is safe to return.
3. Beware of extremely low tides.
4. Never go to the beach to watch for a tsunami. When you see the wave, you are too close to escape.

DEFINITIONS

Earthquake - the shaking or trembling of the earth's surface caused by a sudden movement or displacement in the earth's crust.

Epicenter - the point on the earth's surface directly above the focus of an earthquake.

Fault - a crack or fracture in the crust of the earth along which two blocks of the crust have moved. The movement may be either horizontal or vertical.

Geologist - a scientist who studies the structure of the earth.

Landslide - the sliding down of part of a mass of rock or earth.

Modified Mercalli Scale - a scale used for measuring the local effect or damage caused by an earthquake.

Richter Scale - a scale used for measuring the magnitude of an earthquake.

San Andreas Fault - the master fault of a network of faults in the coastal region of California, extending some 965 kilometers (600 miles) long. Numerous large earthquakes have occurred along this fault.

Seismograph - an instrument used to detect, record, and measure the vibrations produced by earthquakes.

Shock Waves - vibrations produced by the movement and breaking of rocks in the earth's crust.

Tsunami - a great seismic wave of water caused by an undersea quake or volcanic eruption.

LEARNING OBJECTIVE

The student will define earthquake and describe the geologic characteristics of this phenomenon.

ACTIVITIES

1. Discuss the following terms in class and have the students define these:

   earthquake
   epicenter
   fault
   focus
   Richter scale
   seismic
   seismograph
   shock wave
   tectonic
   tremor
   tsunami

2. Have students complete the Wordsearch Puzzle and define the words they find (Activity Sheet E-1).
3. The "solid" earth is actually in a constant state of motion. Have a student or students report to the class on the geologic and solar forces which produce the stresses and movements within the earth's surfaces. Explain what happens during an earthquake.
4. Discuss faults and the movements within the earth's crust (Media Kit). Have students describe the relationship of faults to seismic activity.

LEARNING OBJECTIVE

The student will exhibit an understanding of the destructive force of earthquakes.

ACTIVITIES

1. Have students prepare reports describing famous earthquakes such as the 1964 Alaska quake or the 1974 California quake. What were the devastating effects of these earthquakes?
2. Prepare a bulletin board display showing the effects of earthquakes. Include secondary effects such as fires, landslides, tsunamis, and floods.
3. Construct a model of a seismograph and demonstrate how this instrument measures seismic activity. Discuss the range of intensities on the Richter Scale.
4. Review the Richter Scale and the Mercalli Scale for measuring the magnitude and intensity of an earthquake. Relate these measurements to the extent of damage caused by earthquakes.

5. Define tsunami and give two causes for these giant waves. Explain why they are dangerous and why they should not be called tidal waves.

LEARNING OBJECTIVE

The student will learn the geographic regions in which earthquake activity is most frequent and identify these areas of high seismic activity on state, national, and world maps.

ACTIVITIES

1. Discuss the movement of the earth's tectonic plates and mid-ocean rifts (Media Kit). On a world map, mark these plates and rifts and relate them to earthquake activity (Activity Sheet E-2).
2. Prepare a relief map of the major faults in the United States and plot the location of major earthquakes that have occurred along these.
3. Investigate the probability of earthquakes in your area. Is your state located in an earthquake risk zone? (Activity Sheet E-3). If so, what geological factors are present? Plot on the map major earthquakes that have occurred in the United States.
4. Have a student research and report on the theory of drifting continents and relate this to world-wide seismic activity.

LEARNING OBJECTIVE

The student will explain the safety precautions to be taken during and after an earthquake or tsunami.

ACTIVITIES

1. After discussing the safety procedures to follow during an earthquake, have each student list safety rules for earthquakes and tsunamis.
2. Ask the following questions and have students defend their responses:
   - If you are riding in a car and an earthquake strikes, what should you do?
   - While eating lunch in the school cafeteria, there is an earthquake. What should you do?
   - During an earthquake, you should keep away from windows or large mirrors. Why or why not?
   - If your building has been partially damaged in an earthquake, should you remain in the building? Why or why not?
   - You are at the beach and an undersea quake has been reported thirty miles away. The tide is exceptionally low. What should you do? Why?
3. If you are in an earthquake-prone area, have students prepare a leaflet on earthquake safety. If possible, distribute these in the community.

LEARNING OBJECTIVE

The student will relate the impact of earthquakes on structures and the implications for building codes and zoning ordinances.

ACTIVITIES

1. Using the Seismic Risk Map of the United States (Activity Sheet E-3), identify the zone in which you live. If you are in an earthquake-prone area, appoint a committee of students to investigate and report on the emergency plans and measures for decreasing the vulnerability of people and property to earthquakes.
2. Have one or more students investigate the building codes and zoning ordinances in the community. Do they reflect the earthquake risk in your area? How do they compare with the codes and ordinances in high risk areas? Should the local codes be improved to provide better protection against earthquakes?
3. Have students draw simple floor plans of their homes and the school. Indicate on these plans what should be done if a quake measuring 6.8 on the Richter Scale occurred in your area. What structural portions of the buildings would be subject to the greatest damage? Explain the safety actions which should be taken.

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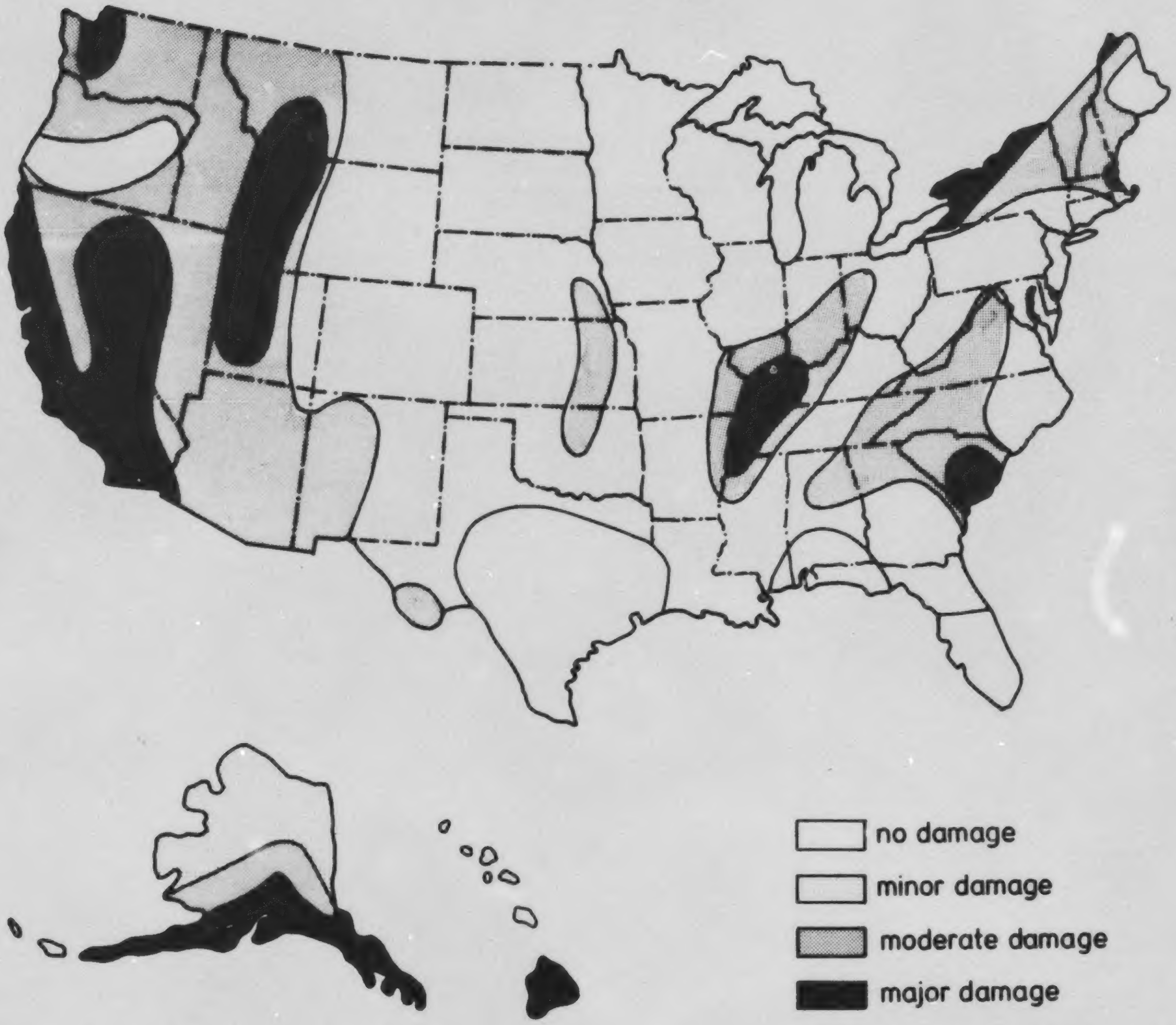
EARTHQUAKE WORDSEARCH PUZZLE

A E A R T P O R V O L C A N O Q N I L S R I
S T T S P N S I H F S O P O T R T Y R A S S
U E N O R U T C P O O M L P O S A R T N E O
R A I U L S M H A C U P N Q S E L M S A V S
A R P S U T Y T R U V R H U A V F C P N A E
T T S L M V F E G S H E A R W A V E S D W I
M H O P A I C R O O O S U A T W T P L R Y S
O Q P A G N C S M U S S T P V Y S I M E R M
P U U T N T P C S V T E A B S R U C N A A A
C A H F I E M A I D X D P S A A M E O S D L
O K T A T N N L E T R A T T T M A N P F N S
S E A U U S O E S L B I S U Y I M T S A O W
T R U L D I K T F M F R M H L R I E A U C A
P S L T E T L S A A A T A A M P M R U L E S
T L F K S Y S S M T U L S T R S N O L T S F

Compressed Air
Earthquake
Epicenter
Fault
Focus
Intensity
Isoseismal
Magnitudes
Primary Waves
Richter Scale
San Andreas Fault
Secondary Waves
Seismic
Seismograph
Shear Waves
Tsunami
Volcano

Seismic Risk Map of the United States


no damage
minor damage
moderate damage
major damage

VOLCANO

The word volcano is derived from Vulcano, an island in the Mediterranean. Centuries ago the ancient Romans believed that this volcanic island, with its hot lava and smoke, was the chimney of Vulcan, the god of fire and metals. Today, we know that volcanoes are not supernatural, but are the result of geological forces inside the earth.

A volcano is the hill or mountain built up by the molten materials which erupt through a vent in the earth's surface. Pressure deep within the earth forces magma or liquid rock to rise and explode violently. A sleeping giant, a volcano alters the geological face of the earth and affects the environment with flows of lava and mud and emissions of gases and ashes.

In the United States, active volcanoes are in the Hawaiian Islands, the Aleutian Islands, Alaska, and in the Cascade Mountains in Washington, Oregon, and northern California. Geysers, steam vents, and hot springs are the effects of waning volcanic activity.

Although potentially hazardous, volcanoes can be beneficial. Much of the earth's natural beauty, mineral wealth, and fertile soil are the result of volcanic activity. In some areas, volcanoes provide a source of geothermal energy.

VOLCANO SAFETY RULES

1. Evacuate the threatened area if ordered to do so.
2. Avoid breathing ash fallout and gas emissions.
3. Avoid touching molten rock and particles which can cause serious burns.

DEFINITIONS

Crater - the bowl-shaped depression, usually at the top of a volcano, which is connected by a vent to the underground magma.

Eruption - the emergence of volcanic matter onto the earth's surface.

Geyser - a spring from which very hot water and steam are thrown into the air.

Lava - liquid or molten rock that has erupted from a volcano.

Magma - molten rock below the surface of the earth that rises in volcanic vents.

Molten - liquified by heat.

Pumice - frothy, lightweight rock produced by the violent separation of gas from rock in a volcanic eruption.

Volcano - (1) a hill or mountain built up by molten materials; (2) a vent or opening in the earth's surface through which molten material erupts.

Volcanology - the science which deals with the study of volcanoes.

LEARNING OBJECTIVE

The student will describe the characteristics of and geologic processes involved in volcanic activity.

ACTIVITIES

1. Using a diagram of a volcano, explain the geological forces in a volcanic eruption (Activity Sheet V-1).
2. Have a student report on the geological history of Yellowstone National Park and explain the evidence of a former period of active volcanism.
3. Construct models of the four kinds of volcanoes: shield, strata, cinder, and dome; explain the composition of each.
4. Have students draw a series of diagrams illustrating the geological development of a volcano. Explain the relationship of earthquakes to volcanic activity.

LEARNING OBJECTIVE

The student will explain the theories on the causes of volcanoes and identify the geographic regions of volcanic activity.

ACTIVITIES

1. Have a student report on Alfred Wegener, the German scientist who first suggested the theory of drifting continents. Discuss the geological evidence in support of this theory.
2. Have students draw a series of posters showing the position of continents at various times in the past. Indicate the directions of the continental movements.
3. On a world map, outline the boundaries of the drifting tectonic plates and the mid-ocean rifts. Relate earthquake and volcanic belts to the movement of these plates and rifts (Activity Sheet V-2).
4. On a map locate the areas of active volcanism in the United States: Hawaiian Islands, Aleutian Islands, Alaska Peninsula, and Cascade Mountains. Discuss the various kinds of volcanic activity in these areas and the significant eruptions that have occurred there.

LEARNING OBJECTIVE

The student will recognize the significance and effects of volcanic activity.

ACTIVITIES

1. Volcanoes have profoundly affected the earth's surface. They have built mountains, formed islands, and altered the courses of rivers. Have each student report on a volcanic eruption that has changed the geological face of the earth.
2. Have a panel of students discuss the threat of future volcanic activity to the people, property, economy and, ecology of the area surrounding the active volcanoes of Hawaii, Alaska and the Pacific Northwest.
3. Have students research the eruptions of Mount St. Helens in 1980. Create a bulletin board describing this volcano and the resulting destruction and fallout. Compare the destruction of Mount St. Helens with significant volcanic eruptions in the past (e.g. Vesuvius, Mt. Pelée, Krakatoa).
4. Have students write a brief paper on the geological lessons scientists have learned from the 1980 eruptions of Mount St. Helens.
5. If you are in an area of active volcanism, have students prepare a list of the safety precautions to take in the event of an eruption. Include information on the hazards of lava flows, airborne debris, pyroclastic rocks and flows, floods, toxic gaseous emissions, and mud flows.

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Shows how volcanoes form and how they alter the earth's surface.

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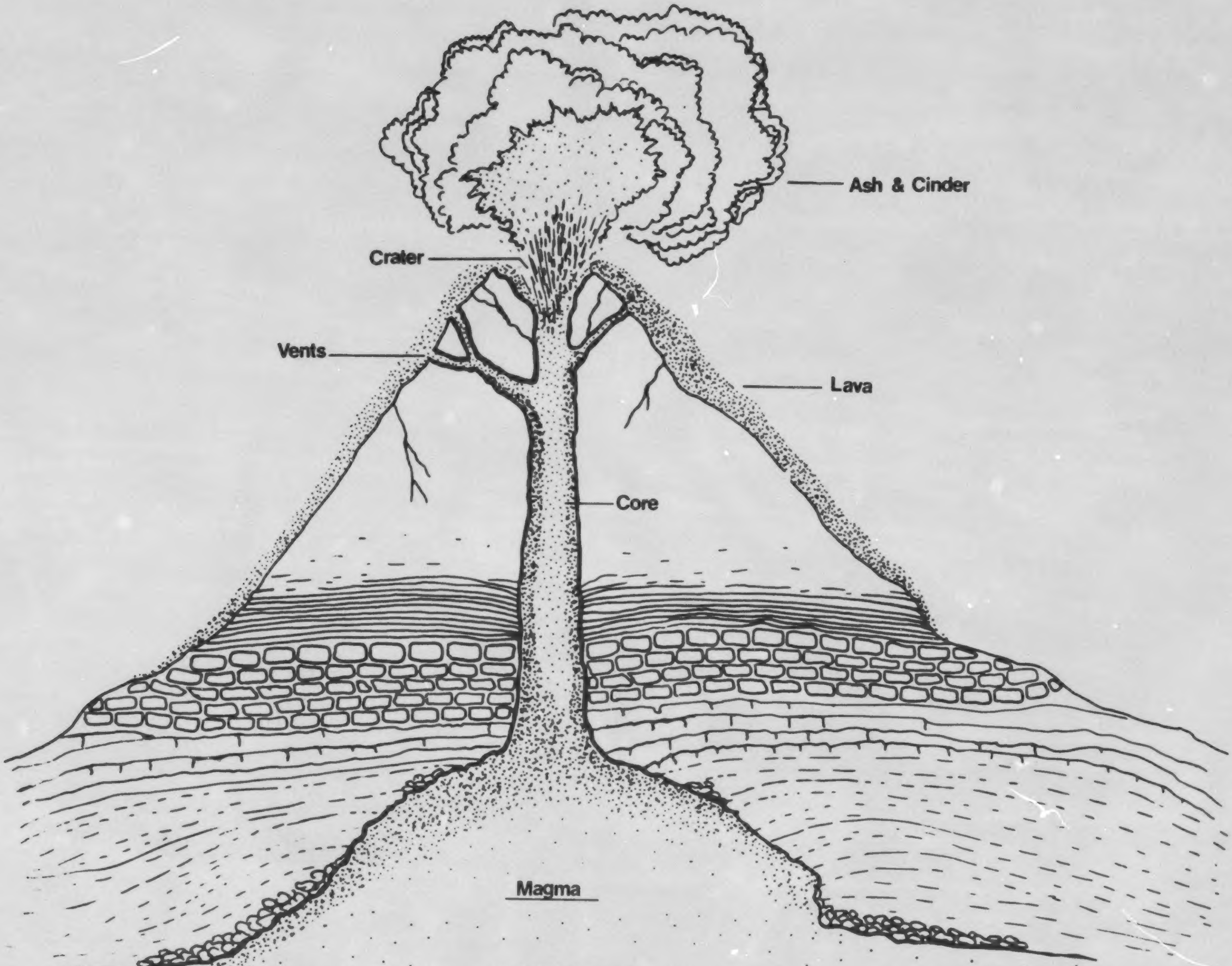
Ash & Cinder
Crater
Vents
Lava
Core
Magma

VOLCANO

MAN-MADE DISASTERS AND EMERGENCIES

Many emergencies are created by technological and industrial development or are the result of human carelessness or error. Nearly every day there are reports of fires, explosions, radiological and toxic chemical accidents, pollution problems, transportation accidents, and energy shortages. We also live with the threat of nuclear attack and the resulting widespread radiation.

As with natural disasters, the lives and property of a great number of citizens are threatened by man-made emergencies. If people are to survive in the modern world, it is necessary to understand these hazards and learn how to guard against them.

EXAMPLES OF MAN-MADE EMERGENCIES AND DISASTERS

chemical spill
power outage
explosion
fire
nuclear attack
Pollution
radiological accident
transportation accident

LEARNING OBJECTIVE

The student will define man-made disasters and cite examples of these.

ACTIVITIES

1. Over a period of time have students collect newspaper and magazine articles about man-made disasters. Include the following questions when reviewing the accounts of these disasters:
   - What types of disasters were reported?
   - Where do they occur?
   - Whom do they affect?
   - What were the responses to these?
   - How could they have been prevented?
   - What caused these disasters? Compare these causes to those of natural disasters.
2. Have the class prepare a list of man-made disasters and emergencies which have occurred in the last year.
3. Appoint a student committee to survey the community and identify the type and location of potential disasters caused by man.
4. Have a student research and report to the class on the man-made disasters which have occurred in your state in the last 10 years.

LEARNING OBJECTIVE

The student will relate man-made disasters and emergencies to technological development and human actions.

ACTIVITIES

1. Debate: Technological and scientific development have been more harmful than beneficial to man and the environment.
2. Using the class-developed list of man-made disasters, have students discuss the hazards and risks associated with these.
3. In a student-prepared display, illustrate the beneficial and harmful effects of technological development.

LEARNING OBJECTIVE

The student will identify various types of technological failures and industrial accidents and recognize the hazardous effects on people and the environment.

ACTIVITIES

1. Have students survey your community for industries and facilities that could be potential disaster sites (e.g. oil refinery, chemical plant, airport, rail yards). Determine the following:
   - What accidents or emergencies are likely?
   - Who would be affected, and how?
   - Would the accident result in environmental damage? If so, what?
   - What preventive and protective measures have been or should be taken?
2. Research and report on legislation and regulations which have been enacted for the protection of people and the environment against industrial and technological accidents and disasters (e.g. OSHA, Clean Air Act, Water Pollution Control Act).

LEARNING OBJECTIVE

The student will describe the protective measures necessary when a chemical accident endangers a group or a large area.

ACTIVITIES

1. Have students identify facilities in which hazardous chemicals are produced or used frequently (e.g. hospitals, industries, drug stores, hardware stores, dry cleaning plants, garages). Appoint a committee to investigate and report on the safety measures used by these facilities in your community to protect against a chemical accident.
2. Simulate a major accident of a specific chemical. Have students produce a skit showing the results of this accident and the response to the emergency by the facility involved, the local or state government, and by local citizens.
3. Indicate on a map of your state the areas most likely to have transportation emergencies involving hazardous materials and the modes of transportation involved.

4. Have students contact shipping carriers to determine what precautions are taken when transporting dangerous cargoes and who is responsible for regulating the movement of hazardous materials. Define the following terms:

    Chem-card
    CHEMTREC
    dangerous cargo
    hazardous material
    toxic substance
    waybill

5. Invite a representative from your local government to discuss the emergency plans for a chemical accident. Determine the likelihood for a chemical accident in your community.

LEARNING OBJECTIVE

The student will explain the hazards of energy-related emergencies and the responses to these.

ACTIVITIES

1. Have students write a paper describing the effects of a fuel shortage on the health and economy of your community.
2. Prepare a visual display illustrating what the federal, state and local governments' response would be to a fuel shortage. Indicate who would assume responsibility for allocating fuel, providing human hardship relief, and instructing private citizens in emergency actions.
3. Simulate a power outage in your community. Have students role-play the response to this emergency by individual citizens, government officials and by commercial, industrial and health care facilities.
4. Have students prepare a list of the materials needed and procedures to follow in the event of a power outage in the home. Encourage the students to discuss these with their families.

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FIRE

Although fire is useful to people and has contributed to the advancement of technology, it can also be dangerous and destructive. In the United States more than eleven thousand lives are lost each year due to fire. The direct cost of fire damage to property is more than a billion dollars a year. Fires caused by natural occurrences such as lightning and volcanic eruptions account for only a small percentage of destruction by flame. Most fires are caused by carelessness or ignorance. People start most fires, and people must learn to prevent them.

Improved fire-fighting methods and knowledge of fire prevention have significantly decreased loss of life, property, natural resources and wildlife. By developing knowledge of fire prevention and protective measures, many lives and large amounts of property can be saved each year. With such knowledge, many individuals will be better prepared to protect themselves and others from the dangers of fire.

FIRE SAFETY MEASURES

GENERAL RULES

1. Keep storage areas free of trash.
2. Check electrical wiring and appliances; replace worn or frayed cords.
3. Do not overload outlets; be careful with the use of extension cords.
4. Use irons and heating appliances with caution.
5. Store gasoline and other flammable fluids in tight metal containers, and do not use indoors.
6. Never store oil or turpentine soaked cloths in the house (spontaneous combustion can occur).
7. Do not place papers or magazines on radiators, or near stoves, fireplaces and floor heaters.
8. Do not allow light bulbs to touch lamp shades.
9. Use a metal fireplace screen; have chimney checked and cleaned regularly.
10. Have a fire escape plan.

HOME FIRE

1. Calmly evacuate the house.
2. Call the fire department or have a neighbor do it.
3. If trapped in a room, stuff material under door to keep smoke from entering; shout for help and keep low to avoid smoke.
4. If necessary, crawl onto roof or other safe area and await rescue (jump from roof only as last resort).
5. Never re-enter a burning building.

SCHOOL FIRE

1. Sound alarm or report fire to teacher or principal.
2. Close doors and windows and evacuate building.
3. Exit to predetermined spot.

FOREST FIRE

1. Report any open fires immediately.
2. Forest fires cannot be outrun but must be outwitted - proceed downhill or upwind (into wind).
3. If told to evacuate area near the fire, do so immediately.
4. Exercise care in building and extinguishing camp fires.

EXTINGUISHING FIRE

1. Extinguish small fires with water, heavy cloth or fire extinguisher.
2. Extinguish electrical fires with sand, baking soda or chemical fire extinguisher.
3. Extinguish grease fires with a lid or baking soda; a damp dish towel can be draped over the pan.
4. Keep all windows and doors closed.
5. Do not walk or run if clothing catches fire. Roll on ground or floor; smother with a blanket, curtain or coat; or beat out flame.

DEFINITIONS

Arson - the deliberate or malicious burning of property.

Asphyxiation - to become unconscious through a lack of oxygen.

Combustion - a chemical change, especially oxidation, accompanied by the production of heat and light (burning).

Conflagration - a large disastrous fire.

Fire - the result of combustion; a process which releases heat and light, thereby heating, destroying or otherwise altering material in its path.

Flame - the glowing, gaseous part of a fire.

Flammable - (Inflammable) - easily ignited and capable of burning with great rapidity; highly combustible.

Fuel - anything consumed to produce energy, especially material such as wood, coal, oil or gasoline.

Ignition Temperature - temperature sufficient to make fuel burn.

Oxygen - an odorless, colorless, tasteless element required for fire to burn.

LEARNING OBJECTIVE

The student will describe the characteristics of fire and identify the causes.

ACTIVITIES

1. Discuss the three elements which must be present for fire: fuel, ignition temperature, and oxygen. Demonstrate how the fire can be extinguished by the absence of one of these elements.
2. Obtain from your local fire department forms for identifying fire hazards in the home. Have students conduct a home fire safety survey and discuss the results in class.
3. Have a student report on the development of fire storms and mass conflagrations. Plot on a map the geographic areas in which these fire storms have occurred in the United States.
4. Discuss the following terms in class and have each student define each:

   - asphyxiation
   - combustion
   - conflagration
   - extinguish
   - fuel
   - ignition temperature

LEARNING OBJECTIVE

The student will develop knowledge of the preventive measures and safety rules for fire.

ACTIVITIES

1. Have each student complete the Home Fire Safety Checklist (Activity Sheet F-1). Using the information from the home survey have each student prepare a fire safety plan for his or her family. Encourage each student to work with the family in eliminating any fire hazards in the home and in conducting home fire drills.
2. Appoint a committee to investigate the fire safety plan for your school. The students should analyze the information, report it to the class, and make recommendations to school officials, if needed.
3. Have students write a short story or play about a group of campers caught near a spreading forest fire. Describe how the campers should respond to the emergency.
4. Have students complete the Fire Safety Quiz (Activity Sheet F-2). Review the rationale and safety rules for each answer.

LEARNING OBJECTIVE

The student will describe the effects of fire on life, ecology and the economy.

ACTIVITIES

1. Have students research and report to the class on the economic loss and ecological damage resulting from forest fires in the United States.
2. Invite a local fire official to speak to the class on the damage and destruction caused by fire. Discuss the ways in which individual citizens and community officials can participate in fire prevention.

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Shows the effect of wildfires and fire fighters at work.

Liquids Can Burn. Alfred Higgins. 16mm film, color, 13 minutes, 1973.
Describes the conditions under which flammable liquids become dangerous.

HOME FIRE SAFETY CHECKLIST

Name: ______________________

Complete the following questions with your family.

1. Does your family have a fire drill plan? ______
2. Does your home have a fire extinguisher? ______
3. Why is it important to have a fire extinguisher? ______________

   ____
4. Do you know how to operate an extinguisher? ______
5. What is the telephone number of your fire department? ______________
6. Has your family practiced a fire drill at home? ______
7. List possible fire hazards in your home:
   - a. ______________________________
   - b. ______________________________
   - c. ______________________________
   - d. ______________________________
   - e. ______________________________
8. Draw a diagram or model of your home. Using a colored pencil or crayon, show the escape routes in case of fire.

Parent's signature ______________________

FIRE SAFETY QUIZ

Is it safe? Yes or No!

_____ 1. Your clothes are on fire. Run for help.

_____ 2. The lamp cord is too long. Cover it with a rug.

_____ 3. You have dirty, oily rags. Keep them in a metal container.

_____ 4. Your clothes are on fire. Roll on the floor or the ground.

_____ 5. A child is in the house. Put the matches on the coffee table.

_____ 6. A child is in the house. Keep pan handles easy to reach.

_____ 7. The light cord is frayed. Patch it.

_____ 8. Your family has a fire escape plan. Practice the escape routes.

_____ 9. You smell smoke. Hide under the bed.

_____ 10. You have a lot of old papers and trash. Get rid of them.

_____ 11. You have some gasoline. Keep it in a closed can.

_____ 12. You have some gasoline. Use it to start the charcoal grill.

_____ 13. A fire is burning in the fireplace. Burn trash in it.

_____ 14. The light cord is frayed. Get rid of it.

_____ 15. You smell smoke. Get out of the house or building.

_____ 16. Some people smoke. Have plenty of ashtrays.

_____ 17. You are getting new pajamas and a robe. Ask for flame-retardant material.

_____ 18. The pan is on fire. Smother it with a lid, baking soda or heavy cloth.

_____ 19. You have a fresh Christmas tree. Keep it in water.

_____ 20. Your house is on fire. Be calm. Get out quickly.

_____ 21. The house is full of smoke. Keep low.

_____ 22. You smell smoke and hear fire alarms while in a tall building. Take the elevator.

_____ 23. You smell smoke and the door feels warm. Open it.

_____ 24. You smell smoke at night; the door is warm to touch. Crawl along the floor to a window.

_____ 25. A fire is burning in the fireplace. Remove the screen so you can get closer to the warmth.

Adapted from *Disaster Preparedness: An Elementary Curriculum Guide.* Kentucky Department of Education, p. 193.

POLLUTION

A polluted environment poses a direct threat to people, plants and animals. Pollution in its various forms can be both material as in gases and exhaust emissions and non-material as in excessive noise or light.

MAN-MADE POLLUTION

Although science and technology have produced tremendous benefits for enhancing life on our planet, they have also produced hazards and problems for human, plant and animal life. Industrial and urban areas have more pollution than rural environments. The following are examples of man-made pollutants:

aerosal sprays
exhaust fumes from vehicles
fumes, smoke and chemical wastes
litter and garbage
loud noises
oil spills
sewage
smog

NATURAL POLLUTION

Not all pollution is caused by man. People and the environment can be adversely affected by pollution found in nature. Examples of natural pollution are:

dust storms
fallout from volcano eruptions
pollen
sedimentation in streams and rivers
smoke from fires started by lightning
thunder and the sound of strong winds

SOME METHODS OF PREVENTING POLLUTION

1. Use pollution control devices in factories and on vehicles.
2. Treat waste before dumping.
3. Keep noise level low.
4. Keep water clean and pure.
5. Collect materials for recycling.
6. Avoid using bright lights and making excessive noise.
7. Put trash and waste in proper containers.
8. Encourage the design and manufacture of quieter products.
9. Support the enactment and enforcement of laws against pollution.

DEFINITIONS

Biodegradable - capable of deteriorating or breaking down naturally into a natural state.

Contaminate - to spoil, ruin, make impure or pollute.

Ecology - the study of the interaction between living things and their environment.

Particulates - minute particles.

Pollution - contamination of the environment creating a threat to the ecological system.

Recycle - to use again or make usable again.

Sedimentation - the settling of solid matter to the bottom of a liquid.

Smog - fog made heavier by smoke and chemical fumes.

Toxic - of, related to, or caused by a poison or toxin.

LEARNING OBJECTIVE

The student will identify the various kinds and sources of pollution.

ACTIVITIES

1. Appoint a committee to survey your community to identify the sources and kinds of pollution present. Report the findings to the class.
2. Have a panel of students present a discussion on the most serious forms of pollution: air, water, solid waste, chemical waste, and noise. This panel should examine the causes and complex nature of pollution.
3. Divide the class into several small groups to investigate pollution. Learning Center Task Cards are suggested and may be reproduced on individual cards for student use (Activity Sheets P-1, P-1a).
4. Have students complete the Air Pollution Crossword Puzzle (Activity Sheet P-2).

LEARNING OBJECTIVE

The student will describe the effects of pollution on human health and the environment.

ACTIVITIES

1. Using information gathered on the kinds of pollution in your area, have students report on the immediate and long-term physical and environmental effects of this pollution.
2. Write a paper describing your personal reactions to pollution encountered daily (e.g. loud noise, exhaust fumes, litter or smog). Explain how this pollution affects an individual and the entire community.
3. Investigate noise pollution and its effect on the human body; have students compare their pulse rates in a quiet and a noisy environment (Activity Sheet P-3). Record and play tapes of noise pollution in the community.
4. Have students create a bulletin board display illustrating the health and environmental hazards of air and water pollution.
5. The accumulation of toxic chemical waste products poses complex problems to our society. Have students do a case study on the contamination of Love Canal, New York.

LEARNING OBJECTIVE

The student will recognize the responsibilities of individuals, industries, and governments in pollution control.

ACTIVITIES

1. Invite representatives from an ecology group and industry to discuss what individuals and industry can do to protect the environment from pollution. Are the concerns of both groups the same?
2. Have students draft mock pollution control legislation for federal and state governments. In preparing this legislation, the students should evaluate current regulations and propose changes and additional measures needed.
3. Organize students to collect empty bottles, cans and newspapers for recycling. Discuss the merits of recycling waste products.
4. Appoint a student advisory council to examine and evaluate local and state pollution control efforts. Encourage the students to present their recommendations to the appropriate government officials.
5. Pittsburgh was once known as the "Smokey City." Ask a student to report on what industries and the citizens have done to fight air pollution there.
6. Debate: Progress and technological development are more important than protecting our environment.

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Pringle, Lawrence. *Recycling Resources.* New York: MacMillan Publishing Company, 1974.

Taub, Harold. *Keeping Healthy in a Polluted World.* New York: Harper and Row, 1974.

FILMS AND FILMSTRIPS

Ecology: Understanding the Crisis. Encyclopedia Britannica Education Corporation. Six sound filmstrips.

Environments and Ecosystems
Man in Ecosystems
Human Communities Simple and Complex
Creating Imbalances
Destroying the Future
Creating the Future

Designed to be used sequentially, these filmstrips give an overview of pollution and its problems.

The Garbage Explosion. Encyclopedia Britannica Educational Corporation. 16mm film, color, 16 minutes, 1970.
Discusses the serious problem of garbage and the deterioration of our environment.

The Lorax. Bailey Film Associates. 16mm film, color, 24 minutes, 1972.
Dr. Seuss cartoon depicting the various facets of pollution.

Noise: Polluting the Environment. Encyclopedia Britannica Educational Corporation. 16mm film, color, 15 minutes, 1971.
Cites examples of noise pollution and builds a case for noise abatement.

Pollution: Problems and Prospects. National Geographic Society. Two sound filmstrips, color, 11-14 minutes, 1974.

The Land deals with contemporary land use methods.
Air and Water shows what people are doing to understand and combat pollution problems.

LEARNING CENTER TASK CARDS

Task cards are designed to be used with appropriate reference materials.

TASK CARD 1

PURPOSE: To investigate immediate surroundings for air pollution and the solutions to these problems.

PROCEDURE: Find out if your community has air pollution problems. How are those problems being overcome? Suggest additional solutions.

TASK CARD 2

PURPOSE: To investigate air pollution and its effects on weather.

PROCEDURE: Can you think of ways in which air pollution might affect weather? Describe a combination of pollution and weather which could produce an emergency.

TASK CARD 3

PURPOSE: To consider the possible causes of temperature inversion, the environments most vulnerable to this, and how these inversions compound air pollution.

PROCEDURE: Consider why Los Angeles is subject to inversions; name additional areas prone to this problem. Is your area threatened by inversions? Why or why not?

TASK CARD 4

PURPOSE: To identify your community's source of water and determine how it is treated and recycled for further use.

PROCEDURE: Investigate this challenge. Determine the community's source of water. What measures are taken to assure its safety? Do sewage and waste products pollute the water? Is the water monitored for pollutants?

TASK CARD 5

PURPOSE: To realize the changes in balance caused by eutrophication and what causes the problem.

PROCEDURE: Research the process of eutrophication. Trace the environmental changes that lead to the aging of a lake.

TASK CARD 6

PURPOSE: To recognize the many types of recycling possible and the benefits derived from reclamation.

PROCEDURE: List at least three examples of recycling that you have observed. Briefly explain the benefits of these recycling efforts. Then list three examples of products that are not recycled. Which of the six examples contribute to pollution problems?

TASK CARD 7

PURPOSE: To apply scientific techniques for collecting pollution data.

PROCEDURE: Select a nearby stream, river or lake. Take samples from several different areas of the body of water and run these tests:

1. physical condition (taste, color, smell, clarity)
2. pH (use litmus paper)
3. temperature
4. microscopic life

Examine each water sample, make sketches, and identify any organisms observed. Check for solids by putting water in a jar for a day or so; measure the layer depths and composition. Record your observations. Check the body of water periodically and compare the results.

If the water is polluted, consult local officials to determine the causes and methods for dealing with this.

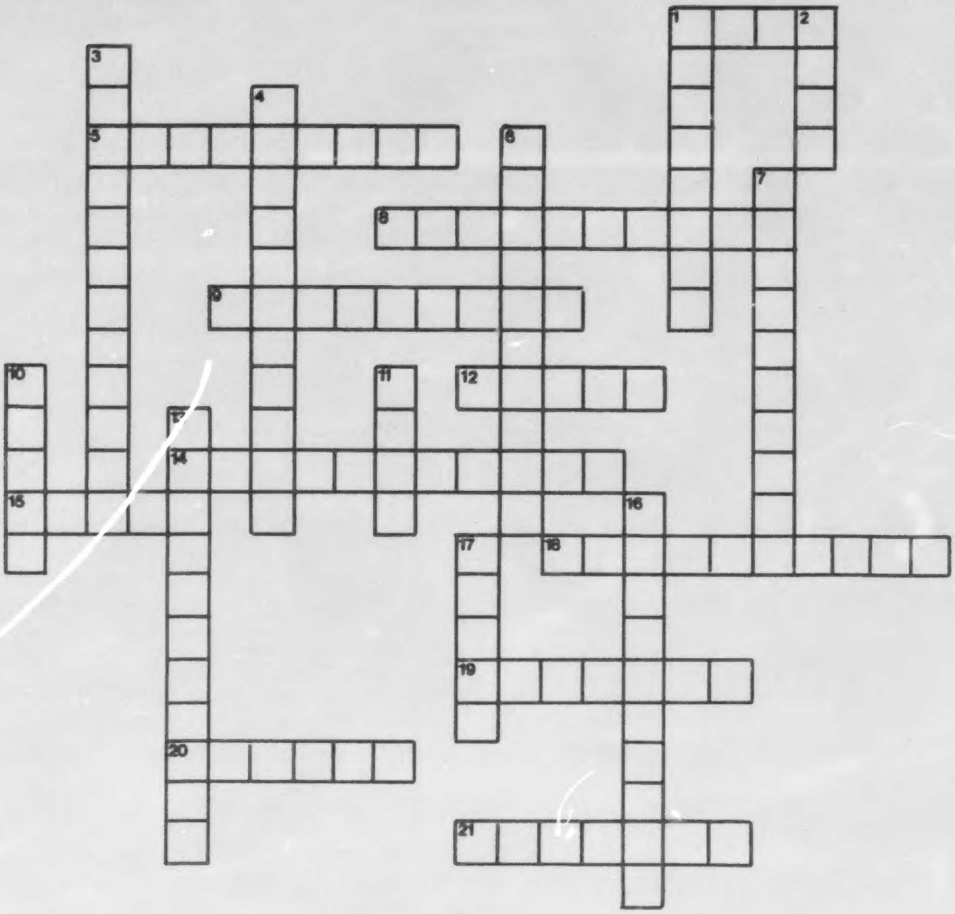
Evaluate the data and prepare a report on the findings.

TASK CARD 8

PURPOSE: To organize a survey, collect data, and to bring about positive action.

PROCEDURE: Make a pollution survey of your town. Determine the levels of air, water and noise pollution. Do chemical and solid waste cause problems? Photograph the sources of pollution and report the results to your class, local newspaper and television station.

AIR POLLUTION CROSSWORD PUZZLE



Across

1. The __________ carries air pollution to other areas
5. A sickness one gets from fallout
8. A transportation vehicle which pollutes the air
9. Manufacturing plants which often pollute the air
12. Diffused matter as smoke or fog suspended in the air making it thick and heavy
14. An organism's entire surroundings
15. Substances that are irritants in the atmosphere
18. A chimney or pipe that discharges smoke into the air
19. The escape of gases into the air from an engine
20. An odorless gas necessary for breathing
21. Radioactive particles in the atmosphere resulting from a nuclear explosion

Down

1. All untamed animals and uncultivated plants
2. Fine particles of dirt in the air
3. Solid unburned particles formed when fuels are burned
4. Being capable of giving off particles of radiation
6. A layer about 15 miles above the ground which protects the earth from the sun's ultraviolet rays
7. Chemicals used on crops to kill insects
10. A part of the living body affected first by air pollution
11. A mixture of smoke, fog and waste gases
13. Air pollution may cause __________ diseases, such as emphysema
16. The process of burning
17. The gases which escape from an exhaust pipe

POLLUTION PUZZLE - ANSWER KEY

Across:

1. wind
5. radiation
8. automobile
9. factories
12. vapor
14. environment
15. gases
18. smokestack
19. exhaust
20. oxygen
21. fallout

Down:

1. wildlife
2. dust
3. particulates
4. radioactive
6. ozone layer
7. pesticides
10. lungs
11. smog
13. respiratory
16. combustion
17. fumes

NOISE AND YOUR HEARTBEAT

EQUIPMENT NEEDED:	A watch with sweep second hand. Noise-making materials.
PROCEDURE:	Show pupils how to find pulse in their wrists or large blood vessel in the throat. (Caution: pressing too hard on the throat will reduce oxygen flow to the brain.)
RATE OF HEARTBEAT IN A QUIET ROOM:	In a quiet room, have each student count the number of heart beats in 30 seconds and record the pulse rate.
RATE OF HEARTBEAT IN A NOISY ROOM:	Ask for 3 volunteers. Take them to the back of the room where their movements will not distract the other pupils. Give them noise-making devices such as books to drop repeatedly on the floor, a ruler to tap on a tin pan, or horns. The sound should be random and not synchronized. When all pupils are ready to count heartbeats, the teacher signals "Begin" and the volunteers create noise. At the end of 30 seconds, the teacher signals "Stop." Pupils write down the number of heartbeats they counted for the second experiment.
	Make a chart. Write in the "before" and "after" rates. The noise should affect the pulse rate. Some may go up, some may go down, but very few will remain the same.

NUCLEAR AND RADIOLOGICAL EMERGENCIES

Radiation is not a modern creation. Since the beginning of time radiation from the cosmic rays of the sun and stars has been present in the universe. The earth itself, with its uranium, granite and other radioactive materials is another source of natural radiation.

The terms nuclear energy and radioactivity are presently the subject of much controversy. The fears are understandable considering that the atomic bomb introduced nuclear energy to the world. In the bombings of Hiroshima and Nagasaki in World War II, the enormous energy possible and potential for destruction in splitting the atom were dramatically shown.

Nuclear science began with the discovery of the X-ray in 1895. Since that time, many beneficial uses of nuclear technology have been developed: sterilizing food, generating electricity, and detecting and treating diseases. During the past several years there has been a dramatic increase in the use of radioactive materials in industrial, medical, educational and research facilities. With this expanded usage there has been a concurrent increase in the shipment of radioactive materials via air, rail and highway.

There is the ever present potential for an accident at facilities using radioactive materials. Within these facilities there could be an explosion, leakage, or reactor malfunction. When transporting radioactive materials, radiation contamination could result from crashes, wrecks or explosions. Of course, the most massive disaster of all would be a nuclear attack on the United States. Protection, survival, and recovery from nuclear emergencies and disasters will be enhanced by an understanding of the hazards of radiation and the protective measures needed to guard against exposure.

PROTECTION AGAINST RADIATION HAZARDS

EXTERNAL RADIATION

1. Reduce the time or duration of exposure as much as possible.
2. Maintain as much distance between the individual and the radiation source as possible.
3. Take advantage of shielding provided by dense objects such as concrete, brick or lead walls.

INTERNAL RADIATION HAZARDS

1. Minimize the amount of time which one spends in an area contaminated with radioactivity.
2. Minimize inhalation of contaminated air and contact with contaminated surfaces.
3. Take full advantage of protective apparel such as boots, coveralls, gloves and filtered or self-contained breathing apparatus.
4. Undergo thorough decontamination with soap and water as soon as possible.

SAFETY PRECAUTIONS TO GUARD AGAINST THE DANGERS OF NUCLEAR ATTACK

PRIOR TO ATTACK

1. Learn to identify community ALERT and WARNING signals.
2. Locate nearest public fallout shelter.
3. Prepare a home fallout shelter and equip with supplies such as:
    - first-aid items
    - canned or packaged food
    - bottled water
    - sanitation items
    - tools, flashlight and battery-powered radio

WHEN WARNING IS RECEIVED

1. Go to nearest shelter.
2. If no shelter is available, construct one as quickly as possible based on previously developed plans.

AFTER THE ATTACK

1. Remain in shelter until advised to leave.
2. Listen for instructions on radio.
3. Wash all unpackaged foods brought into shelter.

DEFINITIONS

Attack WARNING Signal - a 3 to 5 minute wavering sound on sirens, or a series of short blasts on horns, whistles or other devices sounded only in case of enemy attack.

ATTENTION (or ALERT) Signal - a 3 to 5 minute steady blast on sirens, whistles, horns or other devices to warn of an impending natural or man-made disaster or emergency.

Atom - the smallest particle of an element which retains the characteristics of that element. NOTE: at least 20 million atoms could fit on the head of a pin.

Electron - a negatively charged particle which revolves around an atomic nucleus.

Fallout Shelter - a structure which protects people from the danger of radioactive fallout.

Geiger Counter - an instrument for detecting the presence of radiation.

Neutron - a neutral particle present in all known atomic nuclei except the hydrogen nucleus.

Nuclear Radiation - emissions of alpha particles, beta particles or gamma rays from the nuclei of the atoms of radioactive substances.

Nuclear Reactor - a device for producing heat or energy from a nuclear fuel.

Nucleus - the central body of an atom composed of protons and neutrons around which revolve a number of smaller bodies known as electrons.

Proton - a positively charged particle present in all atomic nuclei.

Radiation Sickness - an illness resulting from exposure to radioactive particles causing physical and chemical changes in the cells of the body.

Radioactive Decay - the process of emitting energy over a period of time until the substance loses its radioactivity.

Radioactive Fallout - radioactive particles resulting from a nuclear explosion and descending through the atmosphere.

Radioactivity - the spontaneous emission of energy or particles from the nuclei of radioactive atoms.

X-ray - (1) electromagnetic radiations capable of penetrating solids, acting on photographic film, and of causing flourescent screens to emit light; (2) a photograph obtained by use of X-rays.

LEARNING OBJECTIVE

The student will explain and illustrate the structure of an atom and the characteristics of radioactivity.

ACTIVITIES

1. Discuss atomic structure (Media Kit). Have students write sentences using each of these words:

   atom
   electron
   element
   fission
   fusion
   isotope
   neutron
   nucleus
   proton

2. Have students construct or diagram molecular models to illustrate atomic structure. Discuss why some materials are radioactive and others are not.
3. Using the student-made molecular models, demonstrate radioactive decay and the resulting emission of nuclear radiation. Have the students define and explain the characteristics of alpha, beta, and gamma radiation.
4. Using the instructions for making a cloud chamber (Activity Sheet N-1), demonstrate the emission of radiation.

LEARNING OBJECTIVE

The student will describe the physical and biological effects of radiation.

ACTIVITIES

1. Define rad, rem, millirem, roentgen and milliroentgen. Have students prepare a chart relating the physical effects of radiation doses on people. What are the acceptable levels of radiation exposure?
2. In written or oral reports have students explain both the short- and long-term effects of the atomic bombings on the population and the environment of Hiroshima and Nagasaki.
3. In a panel discussion students should present the causes, symptoms, and treatment of radiation sickness and explain the measures needed for protection against radiation contamination.
4. Obtain an instrument for detecting and measuring radioactivity from your school science lab or local Emergency Management Coordinator's office. Using samples of radioactive and non-radioactive materials, demonstrate the effect of these materials on the instrument and the levels of radiation emitted.
5. Have a student survey household appliances for radiation. Report to the class on any radioactivity detected, the level of radiation present, and the source of the radiation. Appliances which could have some radioactive materials are televisions, microwave ovens, and radium dial clocks. Is this radiation harmful?
6. Have a student read Nevil Shute's novel, *On the Beach*, and report on how a group of people reacted to radiation contamination.

LEARNING OBJECTIVE

The student will compare and contrast the benefits and dangers associated with the non-military uses of nuclear technology.

ACTIVITIES

1. Using the theme "Man and the Atom," have students trace the development of nuclear technology and project future uses of atomic science. Indicate the advantages and disadvantages of this technology. A variety of methods could be used by the students to present this information including: visual displays, charts, graphs, time-line diagrams, and written or oral reports.
2. Discuss the non-military uses of nuclear technology such as medical diagnosis and treatment, industrial research, and nuclear power generation. The students should identify and evaluate the benefits, as well as hazards, associated with the peaceful uses of this technology. What have we learned from the accident at Three Mile Island?
3. Select students to report on the discoveries of nuclear scientists such as Wilhelm Roentgen, Enrico Fermi, Marie Curie, Albert Einstein, Henri Becquerel and Robert Oppenheimer. In the development of nuclear technology, what risks and hazards were these scientists exposed to and what were their contributions?
4. Arrange for the class to visit a nuclear power plant. Discuss with a representative of the plant the risks involved, the safety plans designed for the protection of the employees and the community, and the methods used for the disposal of nuclear waste materials.

5. In a class debate, examine the advantages and hazards in the use of nuclear power. Following the debate have each student evaluate the use of nuclear power and state the reasons for his or her position.

LEARNING OBJECTIVE

The student will recognize the potential for nuclear or radiological disasters and explain the emergency responses needed when an area is threatened.

ACTIVITIES

1. Have students gather newspaper or magazine articles on radiological accidents which have occurred in the last five years. What have been the effects on people and the environment?
2. Select student committees to investigate and report on the responsibilities of government and private industry in the use of radioactive materials.

   - What organizations are involved in radiation protection and what are their functions?
   - What protective measures exist and how are they implemented?
   - Who assumes the lead role during a nuclear emergency or accident?
   - How do the various organizations interact?

   The Nuclear Regulatory Commission, the U.S. Congress, and your state radiation protection office are possible sources of information for this activity.
3. Conduct a survey to determine:

   - Location of nuclear materials in your community.
   - The local transportation routes used for these.
   - Local emergency plans for radiological accidents.

   Plot these facilities on a local map. Ask a local official and industry representative to explain how a radiological emergency would be managed.
4. Demonstrate why time, distance and shielding provide protection from radiation.

   - Complete the demonstrations on distance and shielding (Activity Sheet N-2).
   - Calculate the amount of radiation exposure received for varying lengths of time from the radiation source used in the above demonstration. What conclusions can be made on the relationship of time and radiation exposure?
   - Plot on a graph the decay curve of a gamma-emitting material which has a 24-hour half-life and 200 millicuries of radioactivity.

LEARNING OBJECTIVE

The student will describe the effects of a nuclear explosion, radioactive fallout, and the protective measures needed for survival.

ACTIVITIES

1. Show the film *Protection in the Nuclear Age* and discuss the hazards of a nuclear attack and the actions which would enhance survival.
2. Demonstrate the attack WARNING signal used in your community and have students explain the proper response to this signal.
3. Locate the public fallout shelters in your community and plot these on a map. The students should plan how they would get to a shelter and what items they would carry with them.
4. Select a group of students to role-play life in a shelter in the event of a nuclear attack. The students should determine who would assume shelter leadership and management roles, the life support provisions necessary, and the responsibilities of the shelterees.
5. Invite your local Emergency Management Coordinator to discuss nuclear attack plans for your community.

   - Are you in a high risk zone?
   - If so, what relocation plans have been made?
   - What shelter facilities are available? Where are these located and why are they needed?
   - What is the attack WARNING signal in your community?
   - What is the proper response to the WARNING signal?
   - Who monitors radiation exposure? How?

6. Using graph paper, have students prepare a scale drawing of their homes and indicate the best shelter location in the home. Explain the modifications needed to make the area a suitable fallout shelter. Compile a list of supplies needed by the family for fourteen days in the shelter.
7. Have students complete the Guide for Shelter Planning (Activity Sheet N-3).

LEARNING OBJECTIVE

The student will develop an appreciation for the role of nuclear technology in warfare, foreign policy, and international relations.

ACTIVITIES

1. Research and report on the history of the Manhattan Project which culminated in the atomic bombings in Japan in 1945. Have the students discuss and evaluate the political, military, and moral implications of these bombings.
2. Compare and contrast conventional and nuclear warfare. Does modern warfare make total annihilation possible? How does the threat of nuclear war affect international relations and foreign policy?
3. Define the term "Cold War" and have students trace its origins and development.
4. List the international agreements and treaties concerned with the testing and proliferation of nuclear devices. Select students to discuss the rationale of these treaties and debate the pros and cons. (The U.S. Department of State could be a source of information for this activity.)

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Woodbury, David. *The New World of the Atom.* New York: Dodd, Mead and Company, 1965.

PAMPHLETS

In Time of Emergency. Federal Emergency Management Agency, H-14, reprinted, 1980.

Protection in the Nuclear Age. Federal Emergency Management Agency, H-20, 1977.

FILMS AND FILMSTRIPS

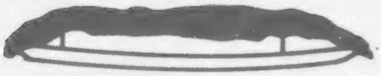
Protection in the Nuclear Age. Federal Emergency Management Agency, DDCP 3-291. 16mm film, color, 23½ minutes.
Describes the hazards of nuclear attack and the necessary preparations for and responses to an attack.

CLOUD CHAMBER

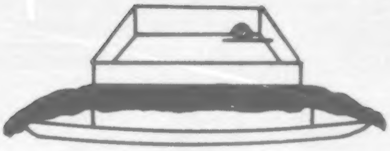
INSTRUCTIONS

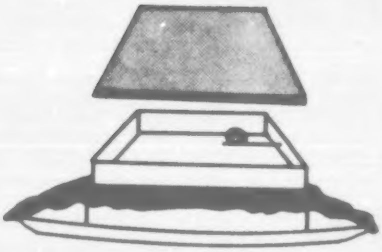
1. Place dry ice in a shallow container.

2. Place a piece of black material over the dry ice.



3. On top of the material, place an open-topped glass dish approximately 4-5" in diameter.
4. Attach a needle to the inside of the dish with glue.
5. On the projecting end of the needle place a radioactive sample.

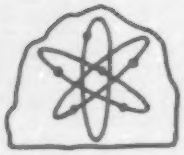




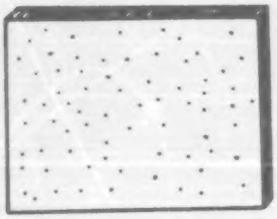
6. Saturate a sheet of cardboard with alcohol and place it on top of the glass container.

7. Cut off lights and observe the cloud tracks produced by radiation.

THE EFFECTS OF DISTANCE AND SHIELDING ON RADIATION



RADIOACTIVE MATERIAL



SHIELDING MATERIAL

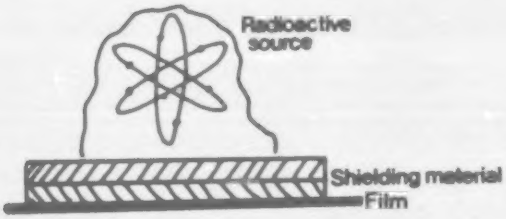
MEASURING DEVICE

MATERIALS

Radioactive material
Radiation measuring device
(Geiger Counter or Dosimeter)
Pieces of wood, metal, brick and concrete
Containers of earth
Graph paper

PROCEDURE

1. Place pieces of a shielding material, one at a time, near the radioactive source. Measure the radiation count after each placement and record the results.
2. Repeat the procedure using each kind of shielding material placed at varying distances from the radioactive source.
3. Plot on a graph the penetration of radiation at the various distances and densities.
4. Analyze the results and formulate conclusions on the effects of distance and shielding for radiation protection.



MATERIALS

Radioactive material
Polaroid 108 film
Shielding materials
(as above)

PROCEDURE

1. Place the shielding material between the radioactive source and the film.
2. Observe on the film the radiation penetration at various thicknesses of shielding material.
3. Record and analyze the observations.

GUIDE FOR SHELTER PLANNING

HOME SHELTER CHECKLIST

Location in Home:

Storm Shelter	Fallout Shelter

SUPPLIES AND STOCK

_____ batteries

_____ battery-powered radio

_____ bedding

_____ books, magazines, games

_____ clothing

_____ cooking and eating utensils

_____ fire-fighting equipment

_____ first aid and health items

_____ flashlight

_____ food

_____ medicines

_____ sanitation items

_____ toiletries

_____ water

PUBLIC SHELTER CHECKLIST

PUBLIC SHELTER	LOCATION	ROUTE
Nearest Home		
Nearest Work		
Nearest School		

SUPPLIES TO TAKE TO SHELTER

_____ battery-powered radio

_____ blankets

_____ flashlight

_____ food

_____ medicines

_____ potable liquids

_____ toiletries

SAMPLE EVALUATIONS

HURRICANE

1. What is the difference between a hurricane WATCH and a hurricane WARNING?
2. A hurricane is a ___________ ___________ with wind speeds of ___________ or greater.
3. Hurricane season extends from early June through ___________.
4. A hurricane warning has been issued and you live in a mobile home. What should you do?
5. Most casualties in a hurricane are caused by ___________.

FLOOD

1. You have been advised that your house is in an area for which a flood WARNING has been issued. What should you do?
2. You have planned a canoe trip for the weekend. A flash flood WATCH has been issued for the area. Should you take your trip? Why or why not?
3. If your car stalls on a flooded highway, what should you do?
4. True or False. If you are caught in a flood and water comes up to the first floor of your one-story house, you should climb out on the roof.
5. Immediately following a major flood, would obtaining drinking water become a serious problem? Why or why not?

TORNADO

1. If you are in a school bus and a tornado is spotted, what should you do?
2. Define tornado WATCH and WARNING.
3. There is a tornado coming and you do not have a basement. Where should you find shelter?
4. The destruction of tornadoes is caused by ____________, ____________, and the ____________ in the center of the vortex.
5. True or False. Most tornadoes occur early in the morning.

THUNDERSTORM

1. Thunder was heard five seconds after a flash of lightning. How far away was the lightning? _____ miles; _____ kilometers.
2. Name five potential hazards of thunderstorms.
3. You are caught in an open field during a thunderstorm. Nearby there is a tall tree. What should you do?
4. Which kind of cloud would give warning of an impending thunderstorm?
5. You have pulled to the side of the road because of a severe thunderstorm. A live wire falls across your car. What action should be taken?

WINTER STORM

1. True or False. A single layer of thick clothing provides the most effective protection against cold.
2. Two symptoms of overexposure to cold weather are __________ and _________.
3. What could happen if a person keeps the car motor running and the windows closed while stranded in a snow storm?
4. What similar weather conditions bring about thunderstorms and winter storms?
5. List four ways you should be prepared in case a severe winter storm isolated you at home.

HEAT WAVE

1. Which temperature reading would be typical during a heat wave?

_____ 25°C

_____ 37.8°C

_____ 44°C

_____ 90°C

2. List five symptoms of heat syndrome.
3. Name the two weather conditions which cause difficulty in the body's ability to dissipate heat.
4. Define homoiotherm and explain why homoiotherms are threatened by a heat wave.
5. What condition is caused by overexposure to ultraviolet radiation?

EARTHQUAKE

1. Although earthquakes may occur anywhere on the earth's surface, the most frequent and destructive quakes occur in what geographical area of the world?
2. An undersea earthquake has been reported thirty miles away. At the beach there is an exceptionally low tide. Why should you evacuate the area immediately?
3. Define fault and explain the relationship of faults to earthquakes.
4. The vibrations produced by earthquakes are detected and measured by instruments called ____________.
5. In an earthquake, most injuries are caused by:

   a. the actual movement of the ground
   b. the damaging and destruction of buildings
   c. intense shock waves

VOLCANO

1. True or False. A volcanic eruption is frequently accompanied by earthquake tremors.
2. Name three ways in which volcanoes change the geological face of the earth.
3. What are the four kinds of volcanoes?

4. Molten rock below the surface of the earth is called __________; after it erupts from a volcano, it is called ___________.

5. Active volcanism is present in which areas of the United States?

FIRE

1. What three elements must be present for a fire to burn?

2. How should a campfire be extinguished?

3. Define conflagration.

4. True or False. Gasoline should be stored in a metal container.

5. Two natural causes of fire are ____________ and ____________.

POLLUTION

1. List three types of pollution.

2. What is an ecosystem?

3. Name three health problems caused by air pollution.

4. True or False. Arsenic found in pesticides is a greater danger than the element mercury.

5. True or False. Since the soil in the earth's surface acts as a filtration system, the ground water supply is not in danger of contamination from industrial waste and agricultural chemicals.

NUCLEAR AND RADIOLOGICAL EMERGENCIES

1. ______________ is an invisible high-energy radiation emitted spontaneously from the nuclei of certain atoms.

2. Explain why some elements are radioactive and others are not.

3. An isotope is radioactive if it: (a) is stable, (b) has no neutrons, (c) has lost its electrons, or (d) emits radiation.

4. Nuclear energy is released through three kinds of reactions: ____________, ____________, and ____________.

5. True or False. Half-life is the time it takes for half of the atoms in a radioactive material to decay.

6. Radioactive materials emit three types of radiation: _________, _________, and _________.

7. The standard unit of measure for radiation is the _________.

8. True or False. Radiation sickness is contagious.

9. The best protection from radiation hazards are: ___________, ____________, and ____________.

10. Which would be the best fallout shelter and why?

    a. the inner core of a tall building
    b. the basement of a steel and concrete building
    c. a small windowless brick storage building located above ground.

EVALUATIONS ANSWER KEY

HURRICANE

1. Hurricane WATCH: A hurricane may threaten an area within 24-36 hours.
   Hurricane WARNING: A hurricane is expected to hit in an area within 24 hours.
2. A hurricane is a tropical cyclone with wind speeds of 119 kilometers (74 miles) per hour or greater.
3. November
4. Evacuate
5. Flooding

FLOOD

1. Evacuate immediately to higher ground.
2. No, because flash flooding may cause a rapid rise in water level and current speeds.
3. Leave the car; do not try to push it to safety.
4. True
5. Yes, it would be a major problem because the flood waters could have contaminated the water supply.

TORNADO

1. Leave the bus and take cover in a nearby ditch.
2. Tornado WATCH: Weather conditions suggest that a tornado is possible.
   Tornado WARNING: A tornado has been sighted.
3. Take shelter in an interior room under a heavy piece of furniture.
4. High speed winds, wind-borne debris, and the partial vacuum.
5. False. Most tornadoes occur in the afternoon and evening hours.

THUNDERSTORM

1. About 1 mile or 1½ kilometers.
2. Lightning, strong winds, heavy rain, hail, and tornadoes.
3. When there is no shelter, avoid the highest object in the area. If only isolated trees are nearby, the best protection is to crouch in the open, keeping twice as far away from isolated trees as the trees are high.
4. Cumulonimbus
5. Stay in the car until someone arrives and removes the wire.

WINTER STORM

1. False. Several layers of clothing entrap and insulate air warmed by body heat.
2. Frostbite and hypothermia
3. Asphyxiation by carbon monoxide
4. Disturbances along the boundary between cold polar and warm tropical air masses caused by the collision of air masses of different temperatures and densities.
5. a. Keep an adequate supply of heating fuel on hand.
   b. Stock an emergency supply of food and water as well as emergency cooking equipment.
   c. Have a battery-powered radio and a flashlight or lantern on hand.
   d. Keep on hand simple tools and equipment needed to fight a fire.

HEAT WAVE

1. 37.8°C
2. Nausea, headache, high pulse rate, heavy sweating, clammy skin, fatigue, shallow breathing, insomnia, loss of appetite.
3. High temperature readings (above 90°F) and high relative humidity (above 75%).
4. Homoiotherm: A warm-blooded organism that maintains an essentially constant body temperature. Severe heat increases the difficulty in maintaining a constant body temperature.
5. Sunburn

EARTHQUAKES

1. Along the "Ring of Fire," the seismically active zone bordering the Pacific Ocean.
2. An earthquake and an extremely low tide are natural tsunami warnings.
3. Fault - a fracture in the earth's crust along which two blocks of the crust have moved. Earthquakes tend to occur along faults.
4. Seismographs
5. b. the damaging and destruction of buildings.

VOLCANO

1. True
2. Volcanoes: build mountains and plateaus, change the course of rivers, create islands.
3. Cinder cone, composite cone, shield volcano, and lava dome
4. Magma is molten rock within the earth; lava is molten rock that has erupted from a volcano.
5. Hawaiian Islands, Aleutian Islands, Alaska Peninsula, and in the Cascade Mountains in Washington, Oregon, and California.

FIRE

1. Fuel, ignition temperature, and oxygen
2. Pour water over the fire and scatter the coals or embers.
3. Conflagration - a large, disastrous fire
4. True
5. Volcanic eruptions and lightning

POLLUTION

1. Air, water, noise, solid waste, etc.
2. The interaction of living organisms and their physical environment functioning as an ecological unit.
3. Headaches, eye irritation, coughing, sore throat, damage to lung tissue, increased difficulty in breathing, etc.
4. True
5. False. One of the most serious pollution problems is chemical wastes that leach into the soil and contaminate the ground water.

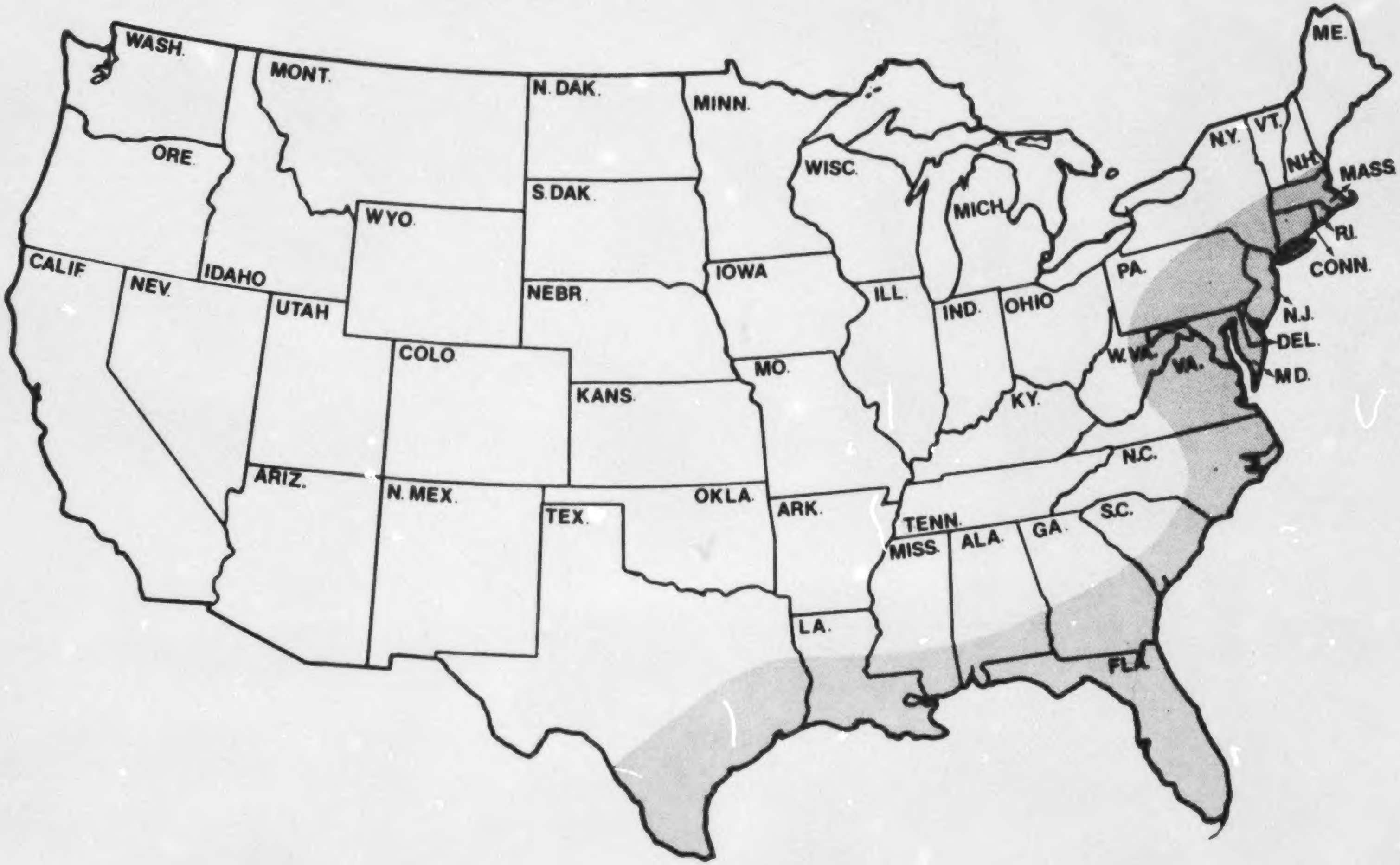
NUCLEAR AND RADIOLOGICAL EMERGENCIES

1. Radioactivity
2. When the ratio of protons and neutrons in an atom is unstable, that element or its isotopes may be radioactive.
3. d. emits radiation
4. Transmutation, fission, and fusion
5. True
6. Alpha, beta, and gamma
7. Roentgen
8. False. The amount and time of exposure to radiation determine its harmful effects.
9. Time, distance, and shielding
10. b. It has thick walls and is located underground.

STUDENT READING LIST FOR ENRICHMENT

TYPE OF DISASTER	TITLE	AUTHOR
Hurricane	*Captains Courageous*	Rudyard Kipling
	Mysterious Island	Jules Verne
	The Serpent's Coil	Farley Mowat
Flood	*The Raging Flood*	R. T. Larkin
Tornado	*Wizard of Oz*	L. Frank Baum
Winter Storm	*To Build a Fire*	Jack London
	Alive	Piers Paul Read
Tsunami	*Phoenix Island*	Charlotte Paul
	The Poseidon Adventure	Paul Gallico
Landslide	*Slide*	Gerald A. Browne
Fire	*The Tower*	Richard Martin Stern
Pollution	*Prophecy*	David Seltzer
Nuclear	*Alas, Babylon*	Pat Frank
	China Syndrome	Burton Wahl
	On the Beach	Nevil Shute
	The Prometheus Crisis	Thomas N. Scrotia and Frank M. Robinson
Survival	*Lucifer's Hammer*	Larry Niven and Jerry Pournelle

The Hurricane Zone of U.S.


WASH.
MONT.
N. DAK.
MINN.
ME.
ORE.
WISC.
N.Y.
VT.
N.H.
MASS.
S. DAK.
MICH.
WYO.
RI.
CONN.
CALIF.
NEV.
IDAHO
IOWA
PA.
UTAH
NEBR.
ILL.
IND.
OHIO
N.J.
DEL.
COLO.
W. VA.
VA.
MD.
KANS.
MO.
KY.
N.C.
ARIZ.
N. MEX.
OKLA.
ARK.
TENN.
S.C.
TEX.
MISS.
ALA.
GA.
LA.
FLA.

HOW TO TRACK A HURRICANE

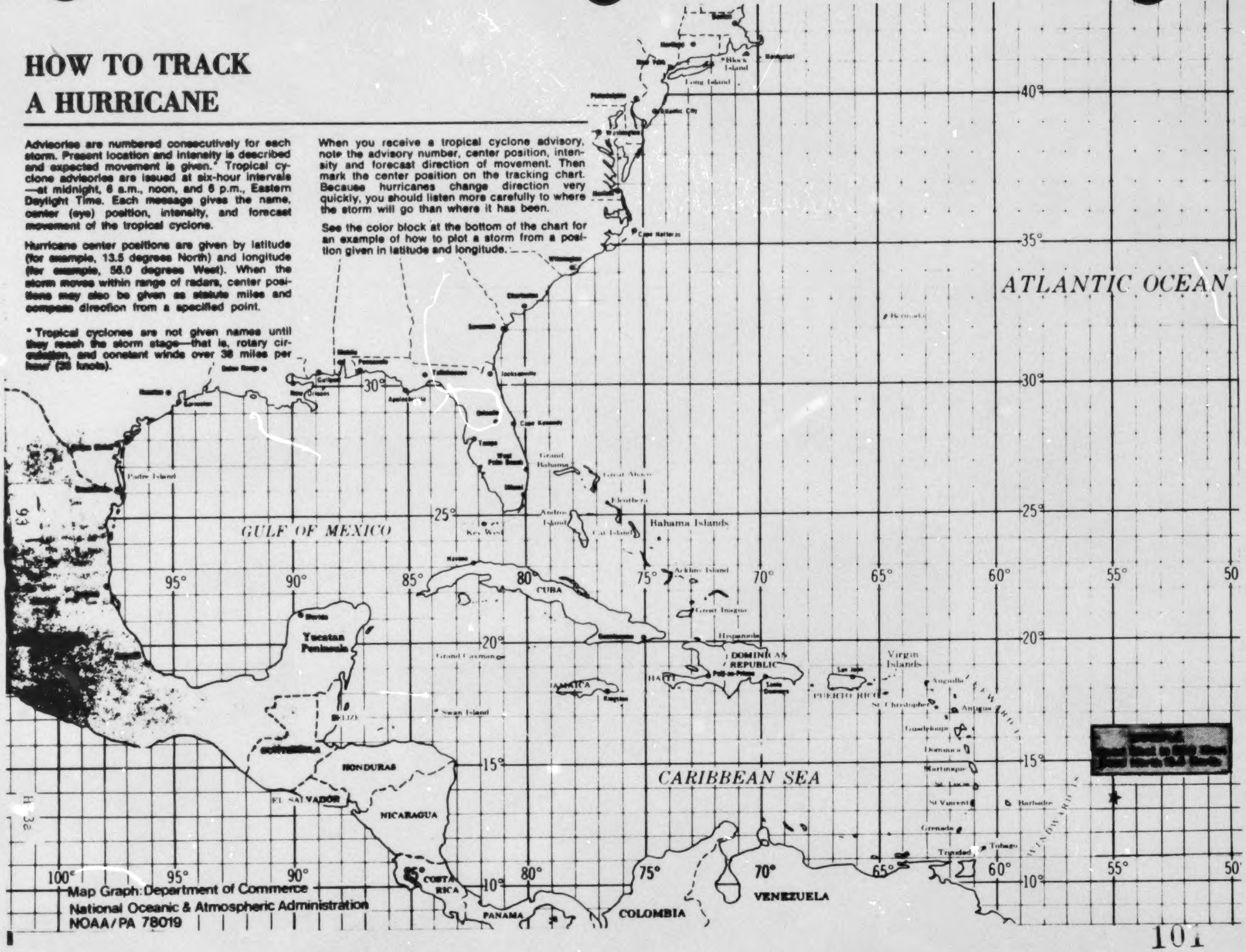
Advisories are numbered consecutively for each storm. Present location and intensity is described and expected movement is given.* Tropical cyclone advisories are issued at six-hour intervals—at midnight, 6 a.m., noon, and 6 p.m., Eastern Daylight Time. Each message gives the name, center (eye) position, intensity, and forecast movement of the tropical cyclone.

Hurricane center positions are given by latitude (for example, 13.5 degrees North) and longitude (for example, 55.0 degrees West). When the storm moves within range of radars, center positions may also be given as statute miles and compass direction from a specified point.

When you receive a tropical cyclone advisory, note the advisory number, center position, intensity and forecast direction of movement. Then mark the center position on the tracking chart. Because hurricanes change direction very quickly, you should listen more carefully to where the storm will go than where it has been.

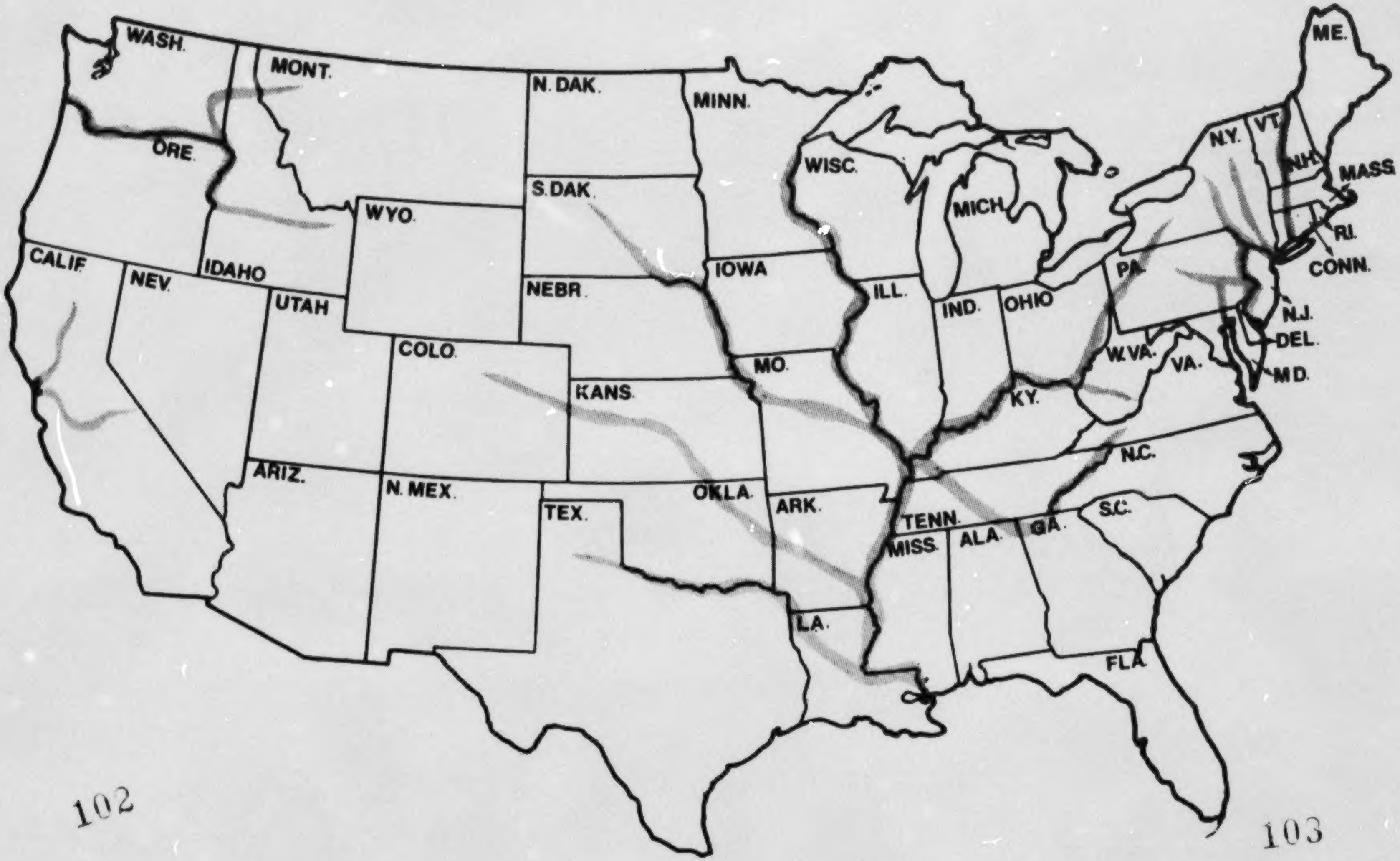
See the color block at the bottom of the chart for an example of how to plot a storm from a position given in latitude and longitude.

* Tropical cyclones are not given names until they reach the storm stage—that is, rotary circulation, and constant winds over 38 miles per hour (33 knots).

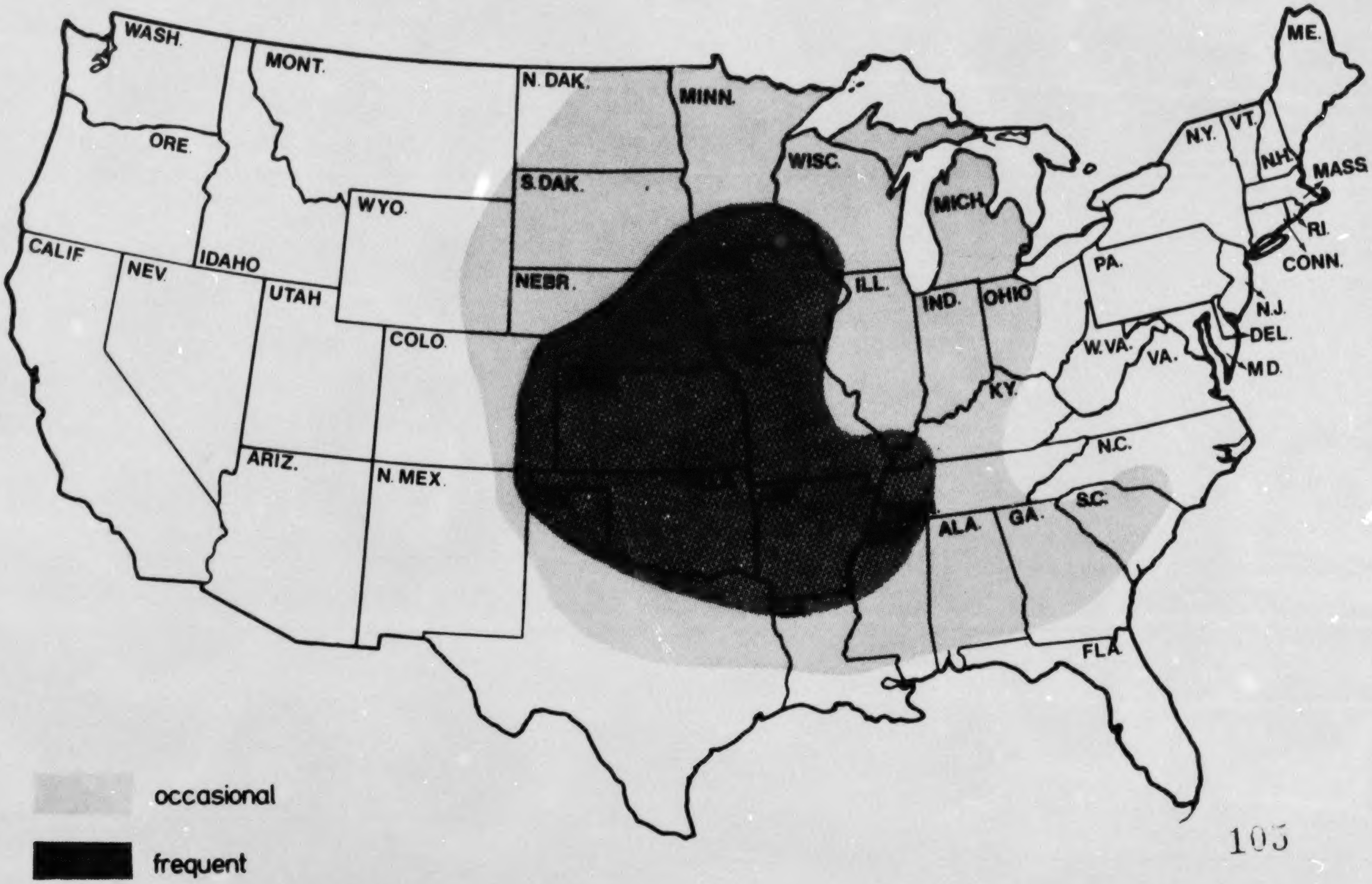

ATLANTIC OCEAN
GULF OF MEXICO
CARIBBEAN SEA
Long Island
Block Island
Cape Hatteras
Apalachicola
Grand Bahama
Great Abaco
Eleuthera
Andros Island
Bahama Islands
Cat Island
Key West
Padre Island
Acklins Island
Great Inagua
Hispaniola
CUBA
Yucatan Peninsula
Grand Cayman
JAMAICA
HAITI
DOMINICAN REPUBLIC
PUERTO RICO
Virgin Islands
Anguilla
St. Christopher
Antigua
Guadeloupe
Dominica
Martinique
St. Lucia
St. Vincent
Barbados
Grenada
Tobago
Trinidad
LEEWARD IS.
WINDWARD IS.
BELIZE
Swan Island
GUATEMALA
HONDURAS
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
COLOMBIA
VENEZUELA
40°
35°
30°
25°
20°
15°
10°
100°
95°
90°
85°
80°
75°
70°
65°
60°
55°
50°

Map Graph: Department of Commerce
National Oceanic & Atmospheric Administration
NOAA/PA 78019

Areas of Severe River Flooding

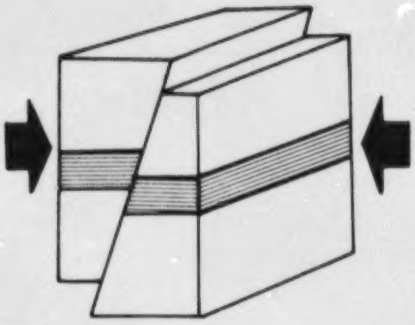

WASH.
MONT.
N. DAK.
MINN.
ME.
ORE.
WISC.
N.Y.
VT.
N.H.
MASS.
S. DAK.
WYO.
MICH.
R.I.
CONN.
CALIF.
NEV.
IDAHO
IOWA
PA.
NEBR.
UTAH
ILL.
IND.
OHIO
N.J.
DEL.
COLO.
W. VA.
VA.
MD.
MO.
KANS.
KY.
N.C.
ARIZ.
N. MEX.
OKLA.
TEX.
ARK.
TENN.
S.C.
MISS.
ALA.
GA.
LA.
FLA.

Most Tornado-Prone Areas of U.S.

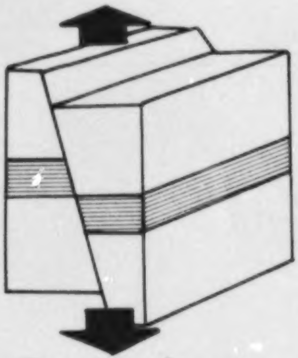

WASH.
MONT.
N. DAK.
MINN.
ORE.
WISC.
S.DAK.
MICH.
WYO.
IDAHO
CALIF.
NEV.
UTAH
NEBR.
ILL.
IND.
OHIO
COLO.
KY.
ARIZ.
N. MEX.
ALA.
GA.
S.C.
N.C.
FLA.
W.VA.
VA.
PA.
N.Y.
VT.
N.H.
MASS.
ME.
R.I.
CONN.
N.J.
DEL.
MD.
occasional
frequent

FAULTS

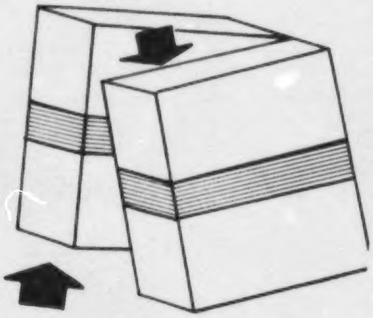
A. Movement of the rock mass against another causes vibrations known as earthquakes.



Compression force

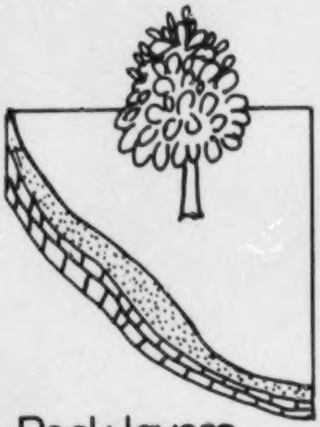


Tension force

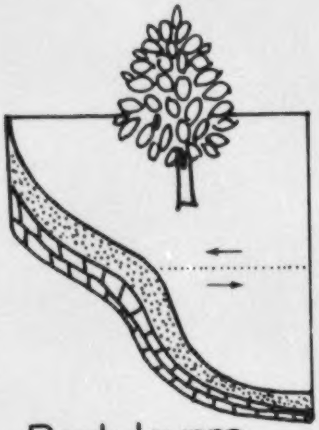


Shearing force

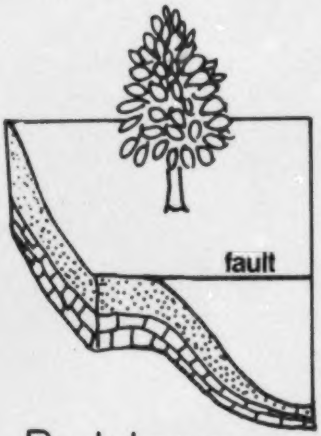
B. Stresses within the earth's crust cause movements of the crust and rocks along lines of weakness.



Rock layers undisturbed

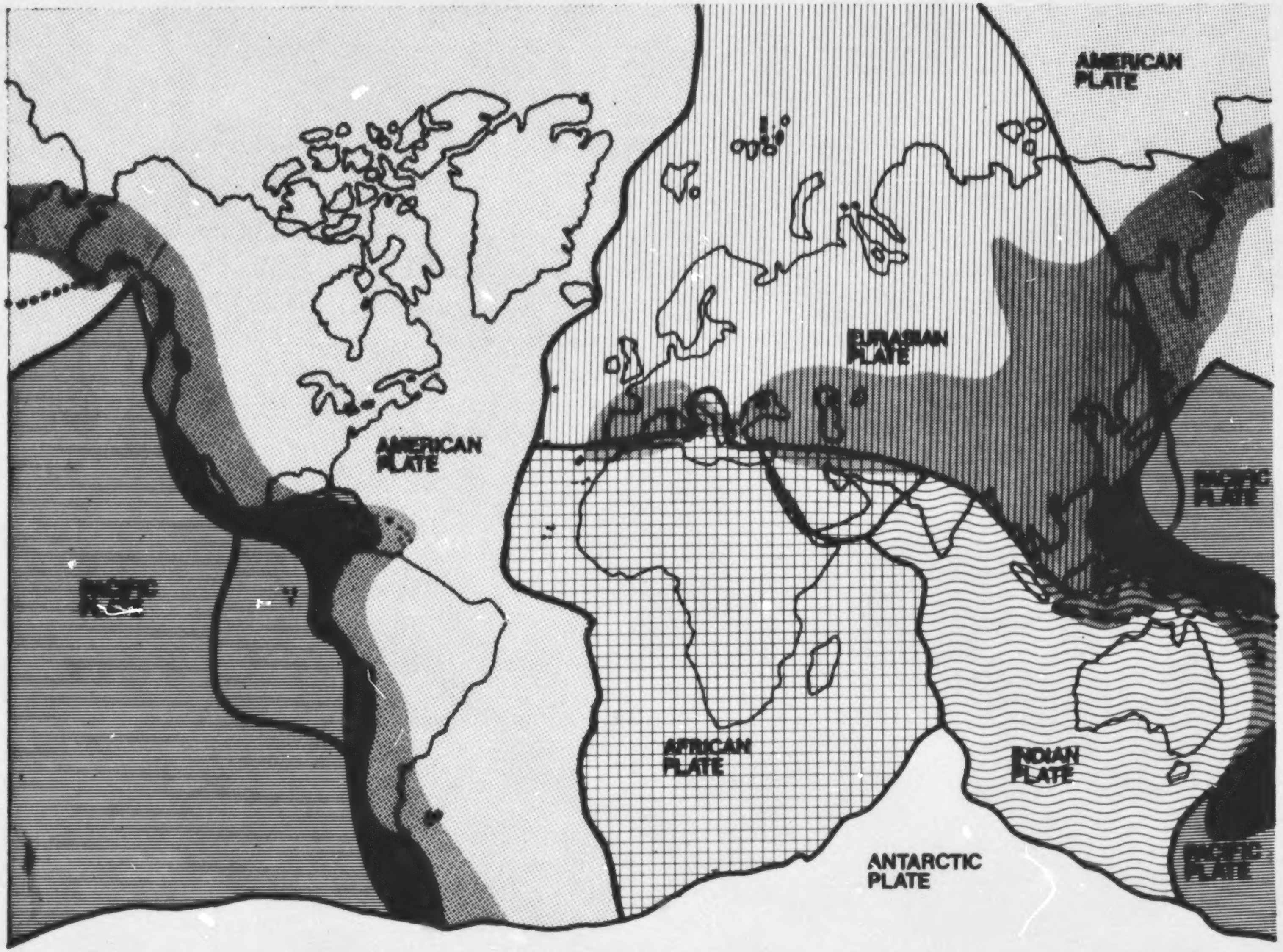


Rock layers under pressure

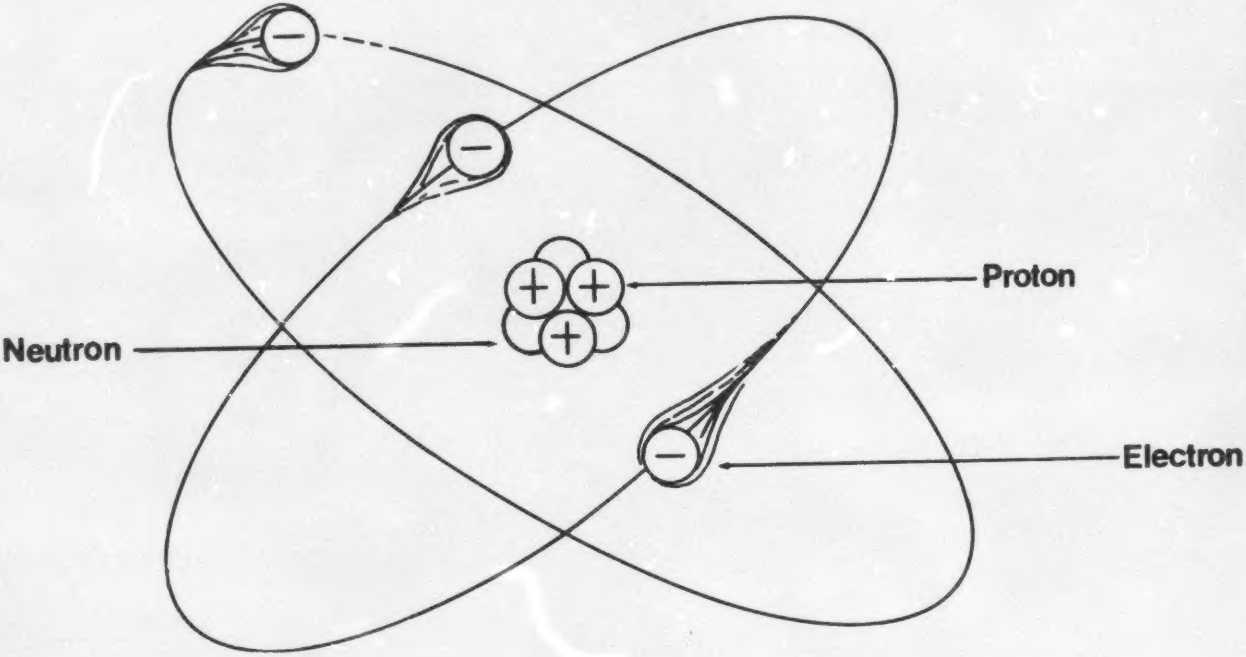


Rock layers after earthquake

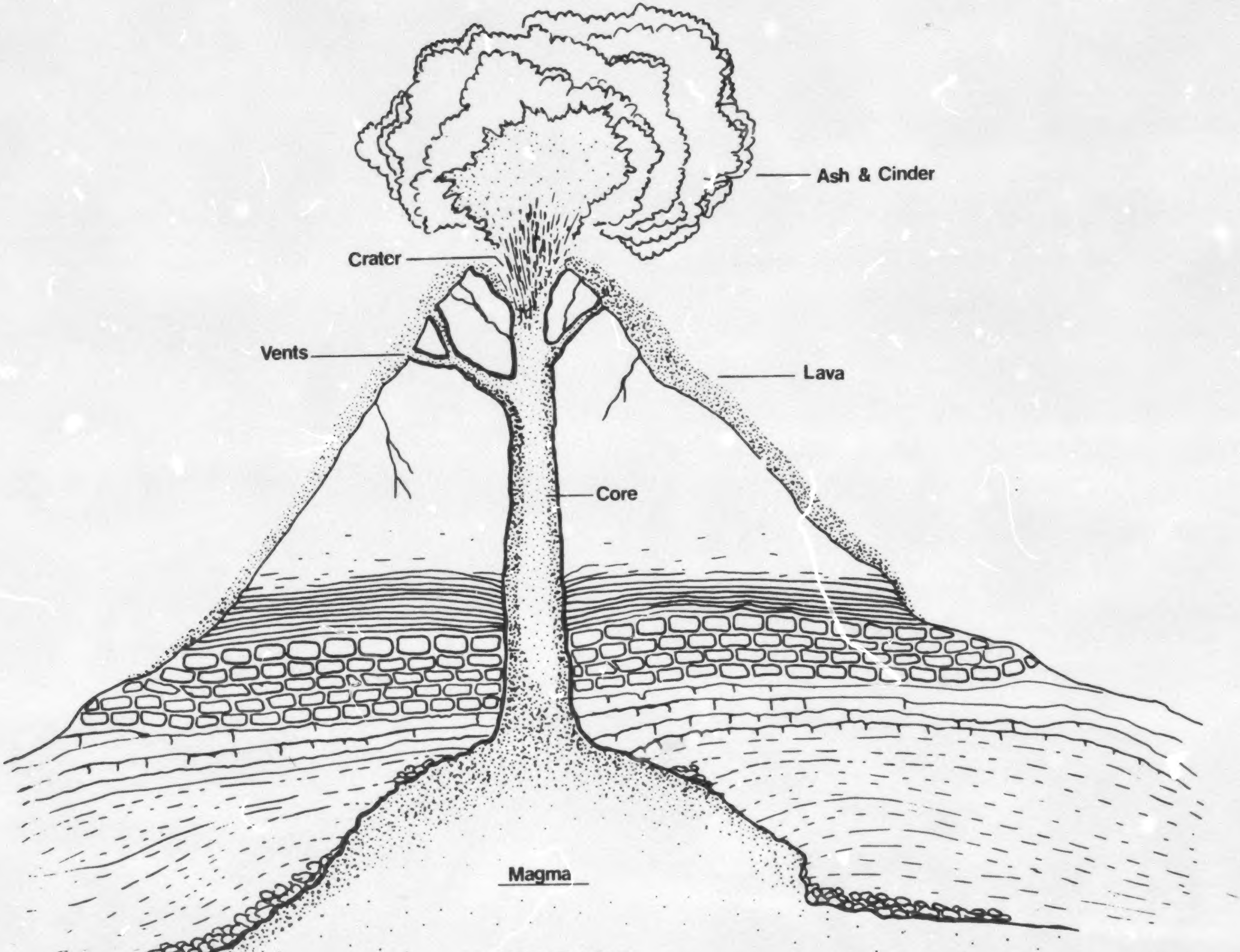
World Seismic Zones


AMERICAN PLATE
AMERICAN PLATE
EURASIAN PLATE
PACIFIC PLATE
PACIFIC PLATE
PACIFIC PLATE
AFRICAN PLATE
INDIAN PLATE
ANTARCTIC PLATE

EARTHQUAKES AND VOLCANOES OCCUR MOST FREQUENTLY ALONG THE PROBABLE BOUNDARIES OF THE EARTH'S TECTONIC PLATES


Proton
Neutron
Electron

Structure of an Atom

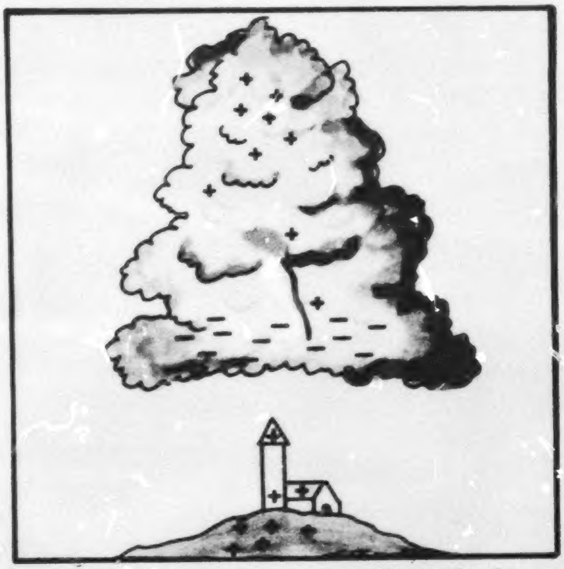

Ash & Cinder
Crater
Vents
Lava
Core
Magma

VOLCANO

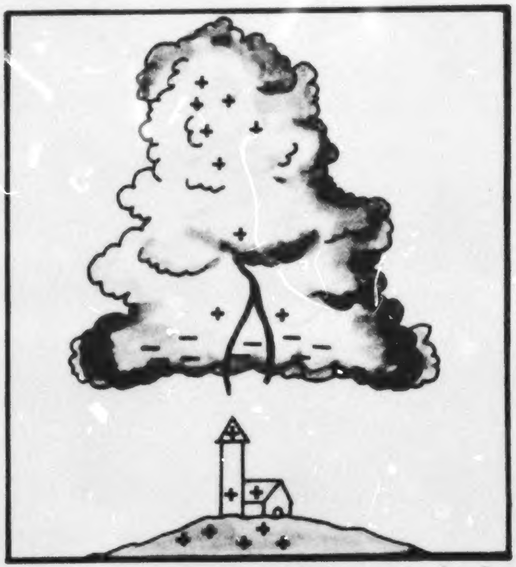
V-1

Life Cycle of a Cloud-to-Ground Lightning Stroke

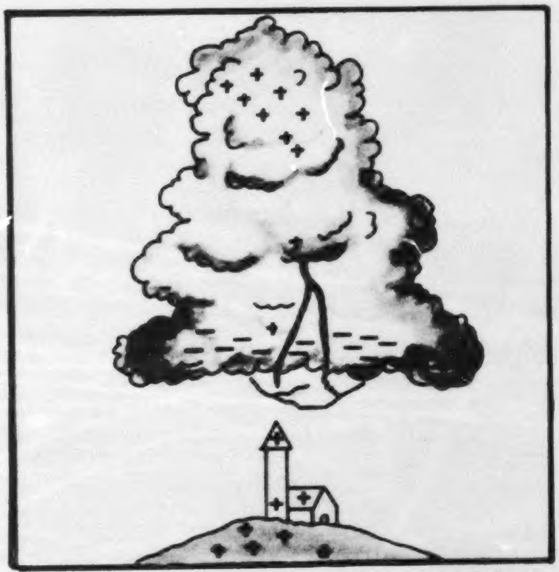
Lightning occurs when the difference between positive and negative charges becomes great enough to overcome the resistance of the insulating air, and to force a conductive path for current to flow between the two charges.



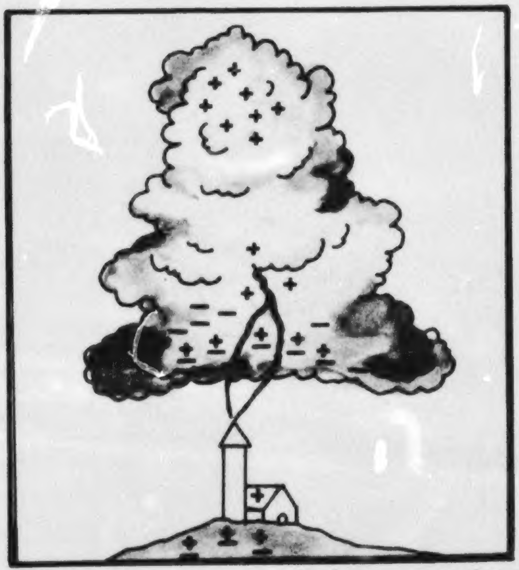
The typical cloud to ground stroke begins as a pilot leader, too faint to be visible, advances downward from the cloud, setting up the initial portion of the stroke path.



A surge of current called a step leader follows the pilot, descending 100 feet (30 meters) or more at a time, pausing, then moving on until the conductive path of electrical (ionized) particles is near the ground.



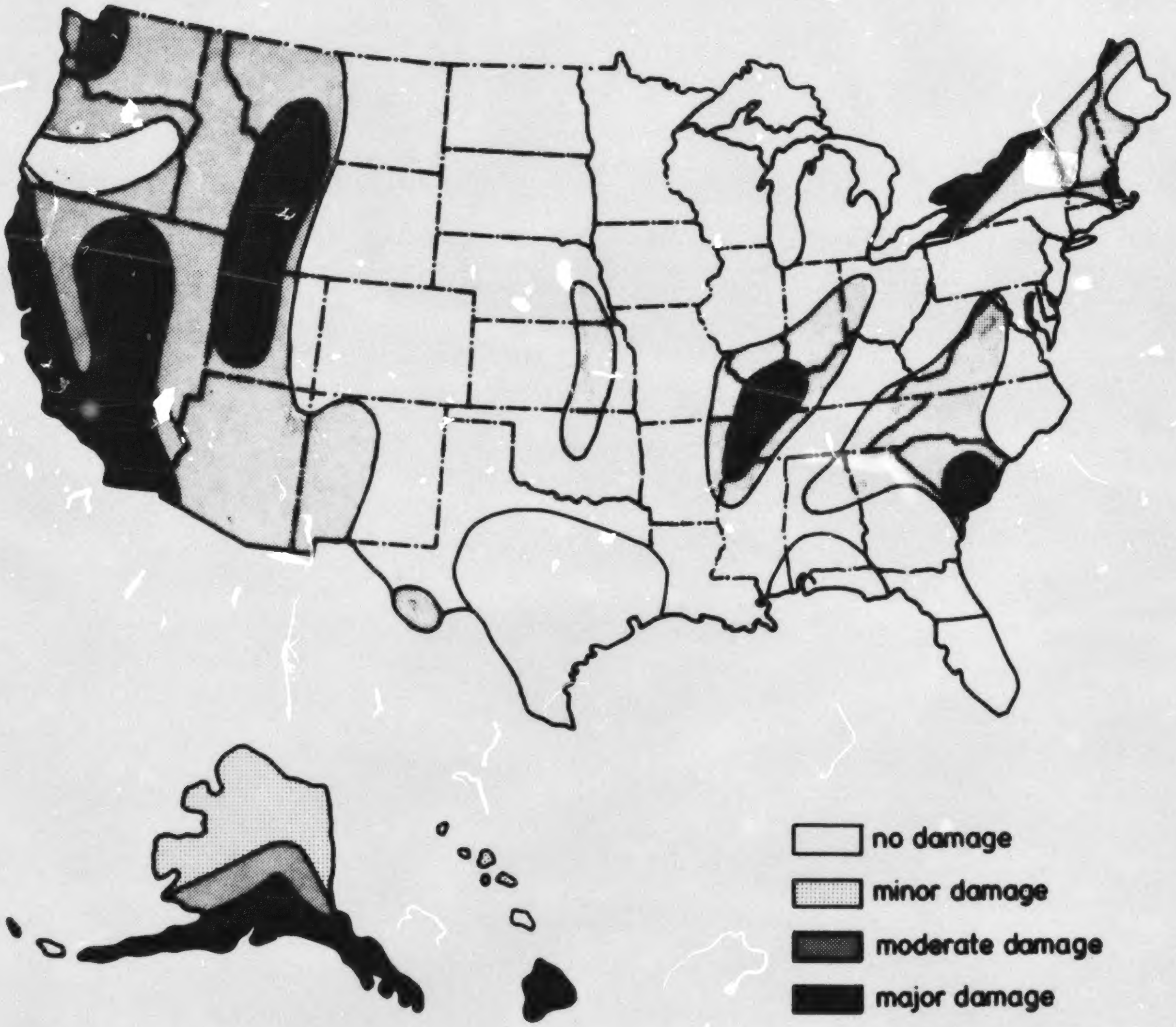
Discharge streamers from the ground intercept the leader path and complete the conductive channel between ground and cloud charges.



When this path is complete, a return stroke leaps upward, illuminating the branches of the descending leader track. Because these tracks point downward, the stroke appears to come from the cloud.

Source: U.S. Department of Commerce,
NOAA/PA 75009.

Seismic Risk Map of the United States



no damage
minor damage
moderate damage
major damage

DISASTER CROSSWORD PUZZLE

Use at least 20 of the following terms to create a crossword puzzle. Write the clues.

1. Alert
2. Blizzard
3. Bomb
4. Crisis
5. Disaster
6. Earthquake
7. Ecology
8. Emergency
9. Emergency Management
10. Evacuation
11. Fallout
12. Fire
13. Flood
14. Food
15. Hurricane
16. Lightning
17. Nuclear
18. Police
19. Radiation
20. Radio
21. Seismic
22. Shelter
23. Shock
24. Storm
25. Survive
26. Tornado
27. Tsunami
28. Volcano
29. WARNING
30. WATCH

GUIDE FOR FAMILY EMERGENCY PLANNING

HOME SHELTER CHECKLIST

Location in Home:

Storm Shelter	Fallout Shelter

SUPPLIES AND STOCKS

_____ water

_____ food

_____ sanitation items

_____ first aid and health items

_____ medicines

_____ bedding

_____ cooking and eating utensils

_____ clothing

_____ toiletries

_____ fire-fighting equipment

_____ battery-powered radio

_____ flashlight

_____ batteries

_____ books, magazines, games

PUBLIC SHELTER CHECKLIST

PUBLIC SHELTER	LOCATION	ROUTE
Nearest Home		
Nearest Work		
Nearest School		

SUPPLIES TO TAKE TO SHELTER

_____ medicines

_____ food

_____ potable liquids

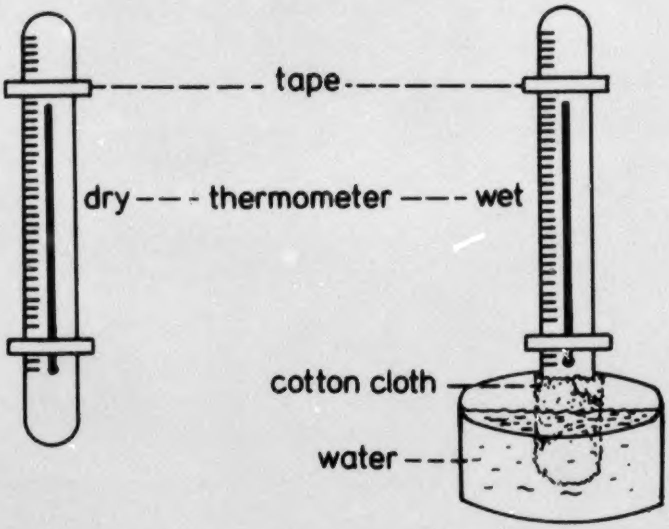
_____ blankets

_____ battery-powered radio

_____ flashlight

_____ toiletries

Wet and Dry Bulb Thermometer
(Hygrometer)

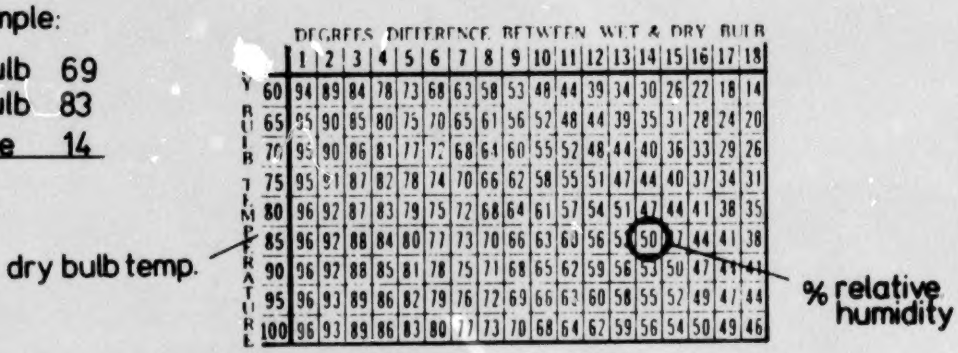


PURPOSE: To measure relative humidity.

PROCEDURE: Allow the wet bulb thermometer to drop in temperature and to stabilize. Read and record both dry and wet bulb temperatures. Subtract the wet bulb temperature from the dry bulb temperature and record.

example:

wet bulb	69
dry bulb	83
difference	14


dry bulb temp.
% relative humidity

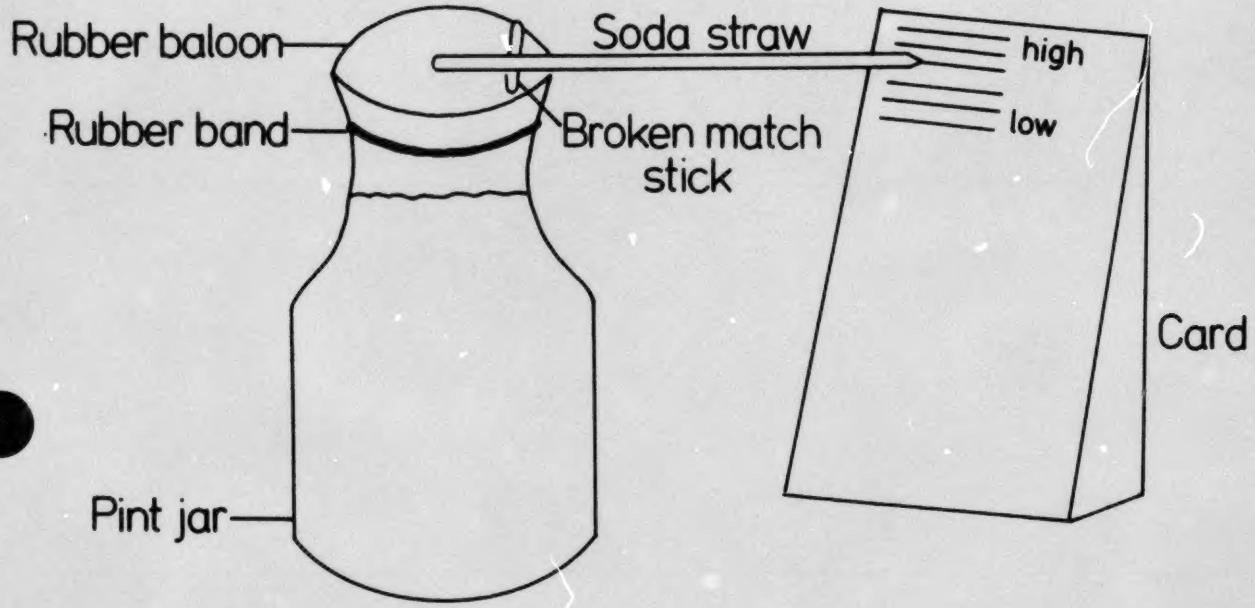
DEGREES DIFFERENCE BETWEEN WET & DRY BULB

DRY BULB TEMPERATURE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
60	94	89	84	78	73	68	63	58	53	48	44	39	34	30	26	22	18	14
65	95	90	85	80	75	70	65	61	56	52	48	44	39	35	31	28	24	20
70	95	90	86	81	77	72	68	64	60	55	52	48	44	40	36	33	29	26
75	95	91	87	82	78	74	70	66	62	58	55	51	47	44	40	37	34	31
80	96	92	87	83	79	75	72	68	64	61	57	54	51	47	44	41	38	35
85	96	92	88	84	80	77	73	70	66	63	60	56	[illegible]	50	[illegible]	44	41	38
90	96	92	88	85	81	78	75	71	68	65	62	59	56	53	50	47	44	41
95	96	93	89	86	82	79	76	72	69	66	63	60	58	55	52	49	47	44
100	96	93	89	86	83	80	77	73	70	68	64	62	59	56	54	50	49	46

Relative humidity table

TO READ THE CHART: Find at the extreme left of the chart the temperature to the nearest 5° equal to the dry bulb temperature. Follow this line of figures across to the column under the figure in the top row equal to the difference between the wet and dry bulb temperatures. In this box is the relative humidity in percent.

ANEROID BAROMETER



PURPOSE: To measure atmospheric pressure.

PROCEDURE: 1) Stretch a rubber sheet (balloon) over the rim of a clean and empty pint jar. 2) Secure sheet with a rubber band. 3) Paste a broken matchstick near the edge of the sheet. 4) Use paste or glue to attach the straw as shown above. 5) Set up a card to one side of the jar. The straw should touch the card. 6) Mark the card where the straw touches.

TO READ THE BAROMETER: Listen to the weather forecast or read a daily newspaper to obtain the correct pressure system for the area on a specific day. Label the mark you have already made either "high" or "low" according to your information. For example, if the pressure is "low" for the day and the next day higher on the card, the pressure has risen and is called "high."

EXTRACTS FROM SIMULATED HURRICANE ADVISORIES

Extract No. 1

NATIONAL HURRICANE CENTER HURRICANE ADVISORY NUMBER 5 CORA NOON EDT SATURDAY AUGUST 23 1980.

AT NOON ... 1600Z ... THE CENTER OF HURRICANE CORA WAS ESTIMATED ABOUT 300 MILES EAST OF THE LEEWARD ISLANDS OR NEAR LATITUDE 17 NORTH LONGITUDE 56 WEST. HOWEVER AT THAT TIME THE FORWARD EDGE OF THE DANGEROUS WINDS WAS ONLY 200 MILES EAST OF THE ISLAND OF ANTIGUA. THE STORM IS MOVING TOWARD THE NORTHWEST AT ABOUT 20 MPH. LITTLE CHANGE IN THE SPEED AND DIRECTION IS EXPECTED DURING THE NEXT 12 HOURS.

MAXIMUM SUSTAINED WINDS ARE ESTIMATED AT 125 MPH BRIEFLY HIGHER IN GUSTS NEAR THE CENTER WITH HURRICANE FORCE WINDS EXTENDING OUTWARD 60 MILES TO THE NORTH AND WEST AND 30 MILES TO THE EAST AND SOUTH. GALE FORCE WINDS EXTEND OUTWARD 125 MILES FROM THE CENTER. THE STORM IS EXPECTED TO DECREASE IN INTENSITY DURING THE NEXT 12 HOURS. THE LOWEST PRESSURE IN THIS SEVERE HURRICANE IS 955 MBS OR 28.20 INCHES.

REPEATING THE NOON POSITION ... LATITUDE 17 NORTH LONGITUDE 56 WEST.

Extract No. 2

NATIONAL HURRICANE CENTER HURRICANE ADVISORY NUMBER 14 CORA 6 PM EDT MONDAY AUGUST 25 1980.

AT 6 PM ... 2200Z ... THE CENTER OF HURRICANE CORA WAS ESTIMATED ABOUT 300 MILES EAST OF THE BAHAMA ISLANDS OR NEAR LATITUDE 26 NORTH LONGITUDE 71 WEST. AT THAT TIME THE FORWARD EDGE OF THE DANGEROUS WINDS WAS ONLY 180 MILES EAST OF CAT ISLAND. THE STORM CONTINUES TO MOVE TOWARD THE NORTHWEST AT ABOUT 20 MPH. THE STORM IS EXPECTED TO CONTINUE TO THE NORTHWEST WITH INCREASED SPEED OF 25 MPH DURING THE NEXT 12 HOURS.

MAXIMUM SUSTAINED WINDS ARE ESTIMATED AT 150 MPH BRIEFLY HIGHER IN GUSTS NEAR THE CENTER WITH HURRICANE FORCE WINDS EXTENDING OUTWARD 50 MILES TO THE NORTH AND WEST AND 25 MILES TO THE EAST AND SOUTH. GALE WINDS EXTEND OUTWARD 120 MILES FROM THE CENTER. THE STORM IS EXPECTED TO INCREASE IN INTENSITY DURING THE NEXT 12 HOURS. THE CENTRAL PRESSURE CONTINUES STEADY AT 27.85 INCHES.

REPEATING THE 6 PM POSITION ... LATITUDE 26 NORTH LONGITUDE 71 WEST.

Extract No. 3

NATIONAL HURRICANE CENTER HURRICANE ADVISORY NUMBER 18 CORA NOON EDT TUESDAY AUGUST 26 1980.

AT NOON ... 1600Z ... THE CENTER OF HURRICANE CORA WAS ESTIMATED ABOUT 175 MILES SOUTHEAST OF WILMINGTON NORTH CAROLINA AND 200 MILES EAST OF CHARLESTON SOUTH CAROLINA OR NEAR LATITUDE 32 NORTH LONGITUDE 76 WEST. THE FORWARD EDGE OF THE DANGEROUS WINDS WAS ONLY 75 MILES SOUTHEAST OF WILMINGTON. THE STORM CONTINUES TO MOVE TOWARD THE NORTHEAST AT ABOUT 10 MILES PER HOUR. LITTLE CHANGE IN SPEED AND DIRECTION IS EXPECTED DURING THE NEXT 12 HOURS.

MAXIMUM SUSTAINED WINDS ARE ESTIMATED AT 125 MPH BRIEFLY HIGHER IN GUSTS NEAR THE CENTER WITH HURRICANE FORCE WINDS EXTENDING OUTWARD 100 MILES NORTH AND WEST AND 75 MILES TO THE EAST AND SOUTH. GALE FORCE WINDS EXTEND OUTWARD 125 MILES FROM THE CENTER. THE STORM IS EXPECTED TO DECREASE IN INTENSITY DURING THE NEXT 12 HOURS. THE CENTRAL PRESSURE CONTINUES STEADY AT 28.00 INCHES.

REPEATING THE NOON POSITION ... LATITUDE 32 NORTH LONGITUDE 76 WEST.

HOW TO TRACK A HURRICANE

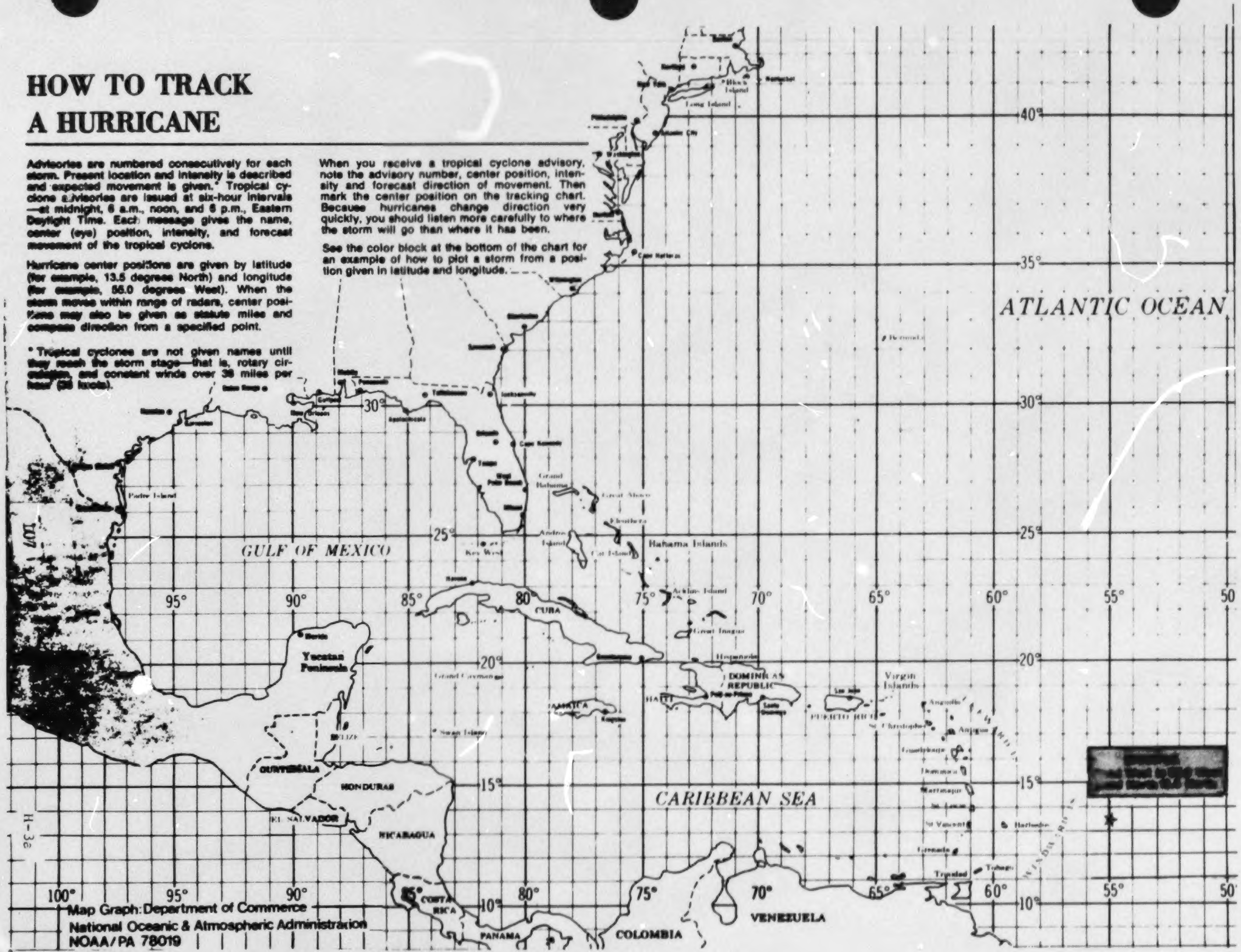
Advisories are numbered consecutively for each storm. Present location and intensity is described and expected movement is given.* Tropical cyclone advisories are issued at six-hour intervals —at midnight, 6 a.m., noon, and 6 p.m., Eastern Daylight Time. Each message gives the name, center (eye) position, intensity, and forecast movement of the tropical cyclone.

Hurricane center positions are given by latitude (for example, 13.5 degrees North) and longitude (for example, 55.0 degrees West). When the storm moves within range of radars, center positions may also be given as statute miles and compass direction from a specified point.

When you receive a tropical cyclone advisory, note the advisory number, center position, intensity and forecast direction of movement. Then mark the center position on the tracking chart. Because hurricanes change direction very quickly, you should listen more carefully to where the storm will go than where it has been.

See the color block at the bottom of the chart for an example of how to plot a storm from a position given in latitude and longitude.

* Tropical cyclones are not given names until they reach the storm stage—that is, rotary circulation, and constant winds over 38 miles per hour (33 knots).



ATLANTIC OCEAN
GULF OF MEXICO
CARIBBEAN SEA
40°
35°
30°
25°
20°
15°
10°
100°
95°
90°
85°
80°
75°
70°
65°
60°
55°
50°
Long Island
Grand Bahama
Great Abaco
Eleuthera
Andros Island
Cat Island
Bahama Islands
Acklins Island
Great Inagua
Key West
Padre Island
Yucatan Peninsula
CUBA
Grand Cayman
JAMAICA
HAITI
DOMINICAN REPUBLIC
PUERTO RICO
Virgin Islands
Anguilla
St. Christopher
Antigua
Guadeloupe
Dominica
Martinique
St. Lucia
St. Vincent
Barbados
Grenada
Trinidad
Tobago
BELIZE
Swan Island
GUATEMALA
HONDURAS
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
COLOMBIA
VENEZUELA

Map Graph: Department of Commerce
National Oceanic & Atmospheric Administration
NOAA/PA 78019

FLOOD WORDSEARCH PUZZLE

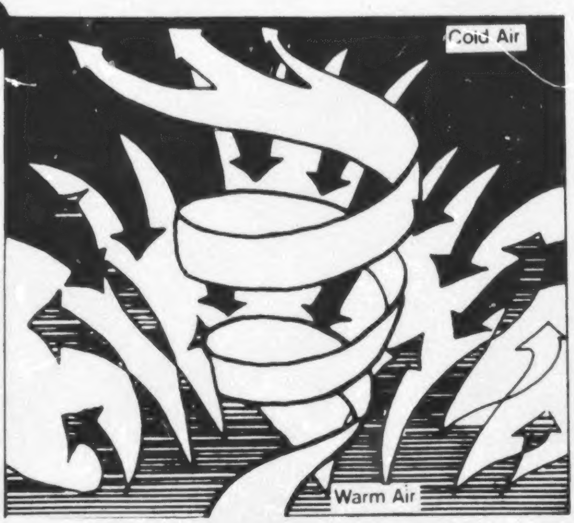
A	O	F	N	O	I	T	A	T	O	R	P	O	R	C
R	N	D	G	H	J	J	D	B	A	S	K	L	R	B
G	U	L	L	Y	Y	M	K	B	E	V	P	O	B	O
M	D	F	A	B	C	G	O	C	R	Z	C	Y	I	U
D	S	E	C	K	I	B	A	P	O	K	A	B	N	L
F	T	H	I	J	L	R	C	W	S	D	M	E	O	D
H	R	G	E	G	R	F	H	L	I	I	J	K	I	E
C	I	I	R	E	L	M	I	L	O	N	N	O	S	R
N	P	P	T	Q	T	D	U	R	N	S	D	T	O	F
O	M	U	N	V	E	W	F	L	O	O	D	S	R	I
I	I	B	O	H	A	W	A	W	A	N	X	X	E	E
T	N	Y	I	Z	A	O	B	S	C	O	D	E	L	L
A	I	Z	T	F	G	L	P	G	H	Y	H	P	I	D
D	N	F	A	D	E	F	I	A	T	I	X	N	O	H
I	G	C	G	K	I	D	P	Q	X	J	N	Q	S	I
X	O	M	I	N	O	U	E	C	O	L	O	G	Y	J
O	R	W	R	U	T	M	S	R	D	W	C	R	K	S
D	X	A	R	V	G	N	I	R	E	H	T	A	E	W
E	Z	Y	I	B	Z	B	E	F	F	T	U	V	G	P
B	A	C	D	N	X	C	O	X	I	D	A	T	B	P
D	I	S	I	N	T	E	G	R	A	T	I	O	N	M
A	H	Y	X	W	V	U	T	S	E	R	Q	P	O	N
T	Z	E	X	F	O	L	I	A	T	I	O	N	Y	Z
B	A	C	D	D	E	F	F	G	H	I	J	K	L	D
O	N	L	S	T	B	L	O	C	K	F	I	E	L	D
P	G	U	U	V	I	A	H	X	G	E	F	J	B	E
F	Q	R	U	S	Q	P	D	O	R	N	C	K	L	M

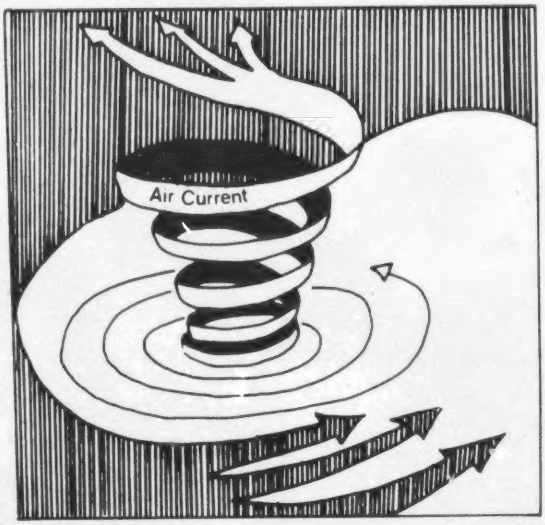
Boulder field
Crop rotation
Ecology
Erosion
Floods
Glacier

Gully
Irrigation
Mud flow
Oxidation
Rain
Rockslide

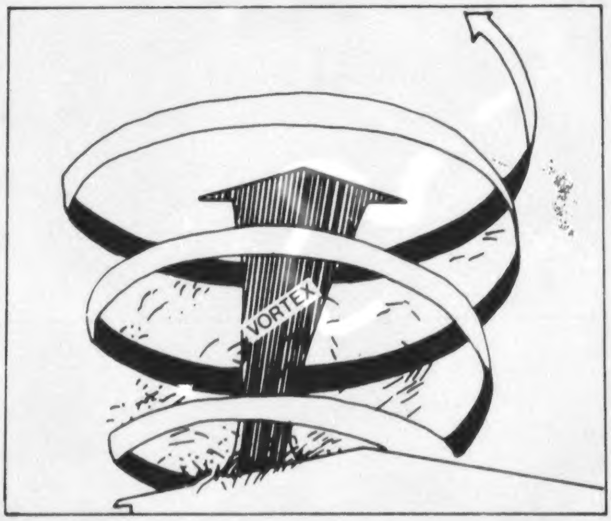
Sheet washing
Soil erosion
Strip mining
Terraces
Weathering
Wind

TORNADO-Nature's Most Violent Wind


Cold Air
Warm Air


Air Current

How does a tornado form and why is it destructive?

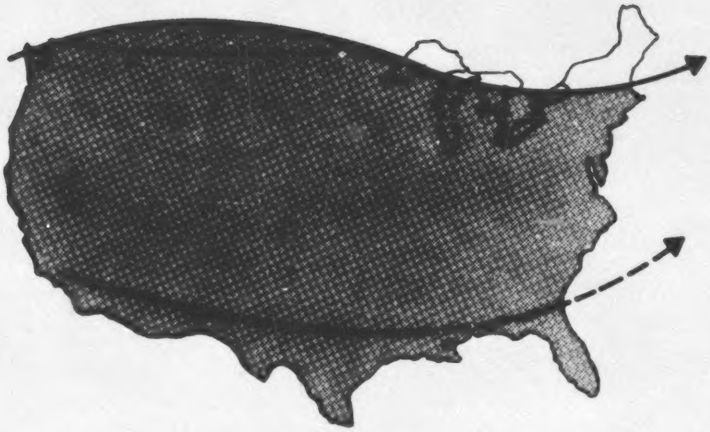


WINTER WEATHER WORDSEARCH PUZZLE

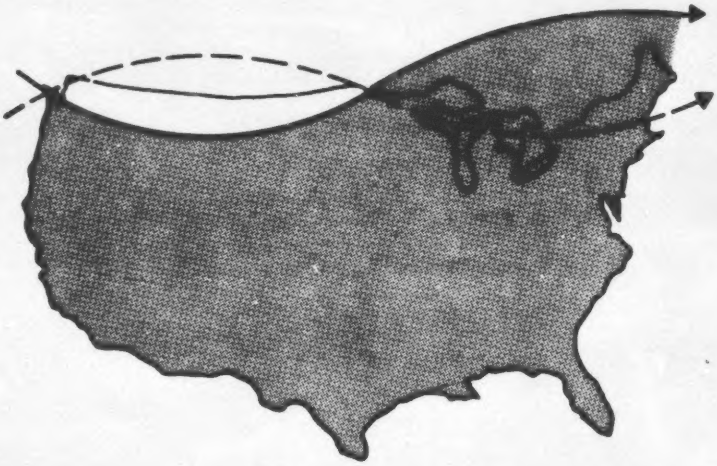
B	X	O	E	D	J	K	A	C	G	L	A	Z	E	P	R
V	I	I	E	V	A	W	D	L	O	C	B	T	Q	S	E
I	E	O	T	V	U	R	I	T	A	G	I	O	L	X	Y
S	C	A	E	P	F	L	Y	N	T	B	E	A	T	H	I
I	K	N	S	J	A	D	I	W	T	L	A	S	F	W	O
B	S	S	I	E	B	U	E	S	H	E	E	T	R	A	S
I	T	H	D	Q	I	T	O	I	S	V	R	T	E	C	J
L	J	E	R	O	L	R	V	F	U	O	P	I	E	I	O
I	U	L	V	K	F	L	R	J	L	O	S	H	Z	F	E
T	A	T	E	A	J	A	G	U	S	M	O	A	I	E	Y
Y	H	E	M	O	N	O	T	V	L	W	T	V	N	O	D
R	I	R	A	A	Z	T	A	Z	L	F	I	A	G	I	U
E	E	W	G	N	E	B	E	E	I	E	N	P	K	U	O
P	B	B	R	S	I	F	G	R	H	C	F	C	E	S	L
P	O	I	K	P	Q	J	D	N	C	D	O	Q	N	A	C
I	E	A	X	M	A	W	L	S	I	N	P	D	R	C	U
L	C	H	W	C	O	I	U	R	X	I	Y	S	R	J	T
S	A	T	S	N	O	W	P	L	O	W	K	O	P	O	V
G	I	B	S	A	R	T	Y	A	P	Z	E	S	T	A	I

Chills
Cloudy
Cold Wave
Flurries
Freezing
Frostbite
Glaze
Permafrost
Salt
Sheet

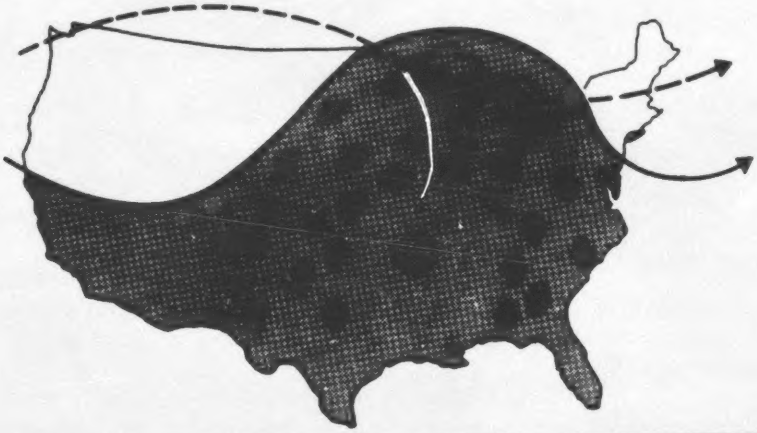
Skiing
Shelter
Slippery
Slush
Snowdrift
Snow plow
Visability
Wind
Winterized
Winter



Normal summer position of jet stream & polar front



Displaced jet stream



Jet stream blocked northward

"In summer, the jet stream can be an ill wind indeed." Explain.

EARTHQUAKE WORDSEARCH PUZZLE

```
A E A R T P O R V O L C A N O Q N I L S R I
S T T S P N S I H F S O P O T R T Y R A S S
U E N O R U T C P O O M L P O S A R T N E O
R A I U L S M H A C U P N Q S E L M S A V S
A R P S U T Y T R U V R H U A V F C P N A E
T T S L M V F E G S H E A R W A V E S D W I
M H O P A I C R O O O S U A T W T P L R Y S
O Q P A G N C S M U S S T P V Y S I M E R M
P U U T N T P C S V T E A B S R U C N A A A
C A H F I E M A I D X D P S A A M E O S D L
O K T A T N N L E T R A T T T M A N P F N S
S E A U U S O E S L B I S U Y I M T S A O W
T R U L D I K T F M F R M H L R I E A U C A
P S L T E T L S A A A T A A M P M R U L E S
T L F K S Y S S M T U L S T R S N O L T S F
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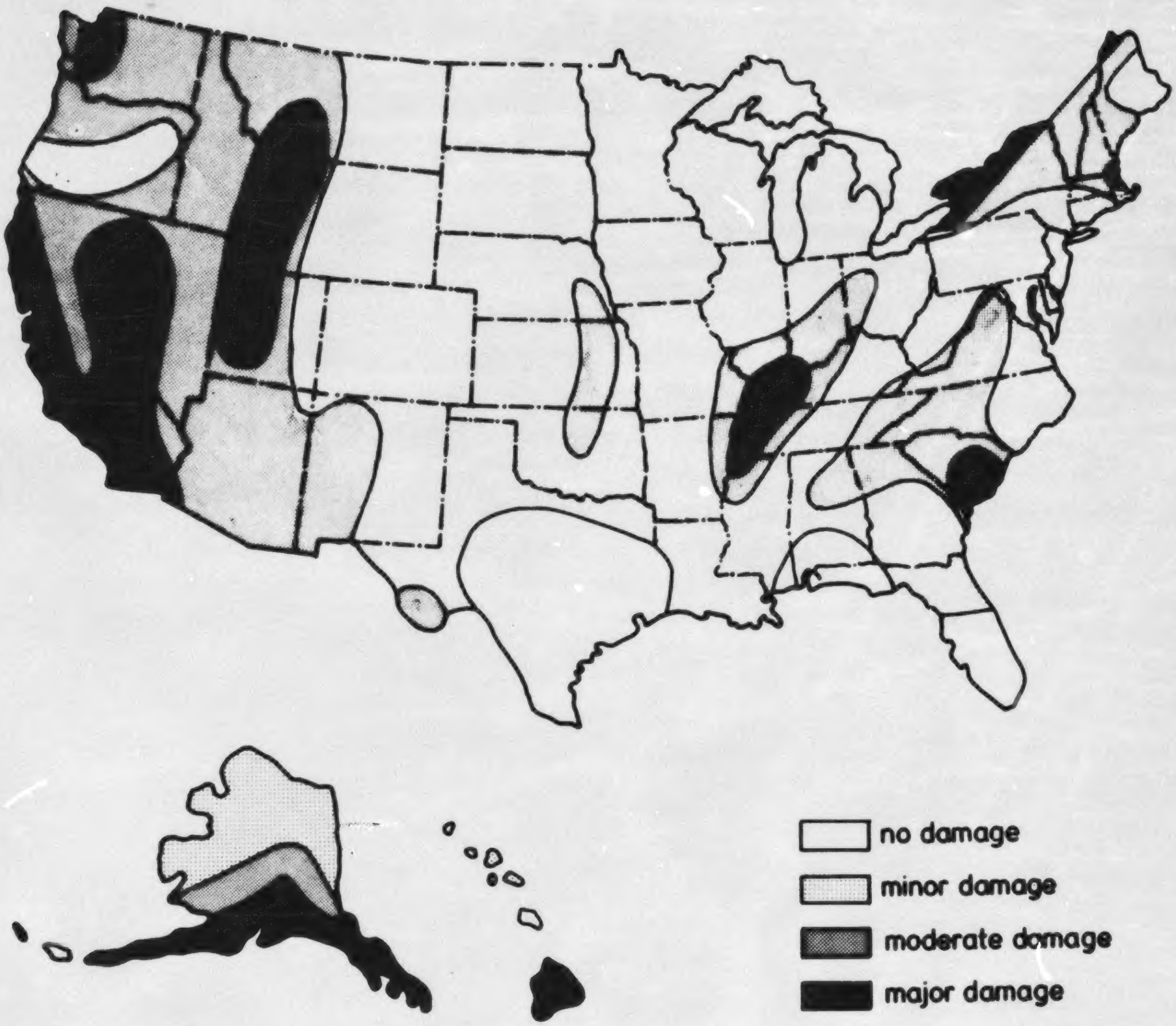
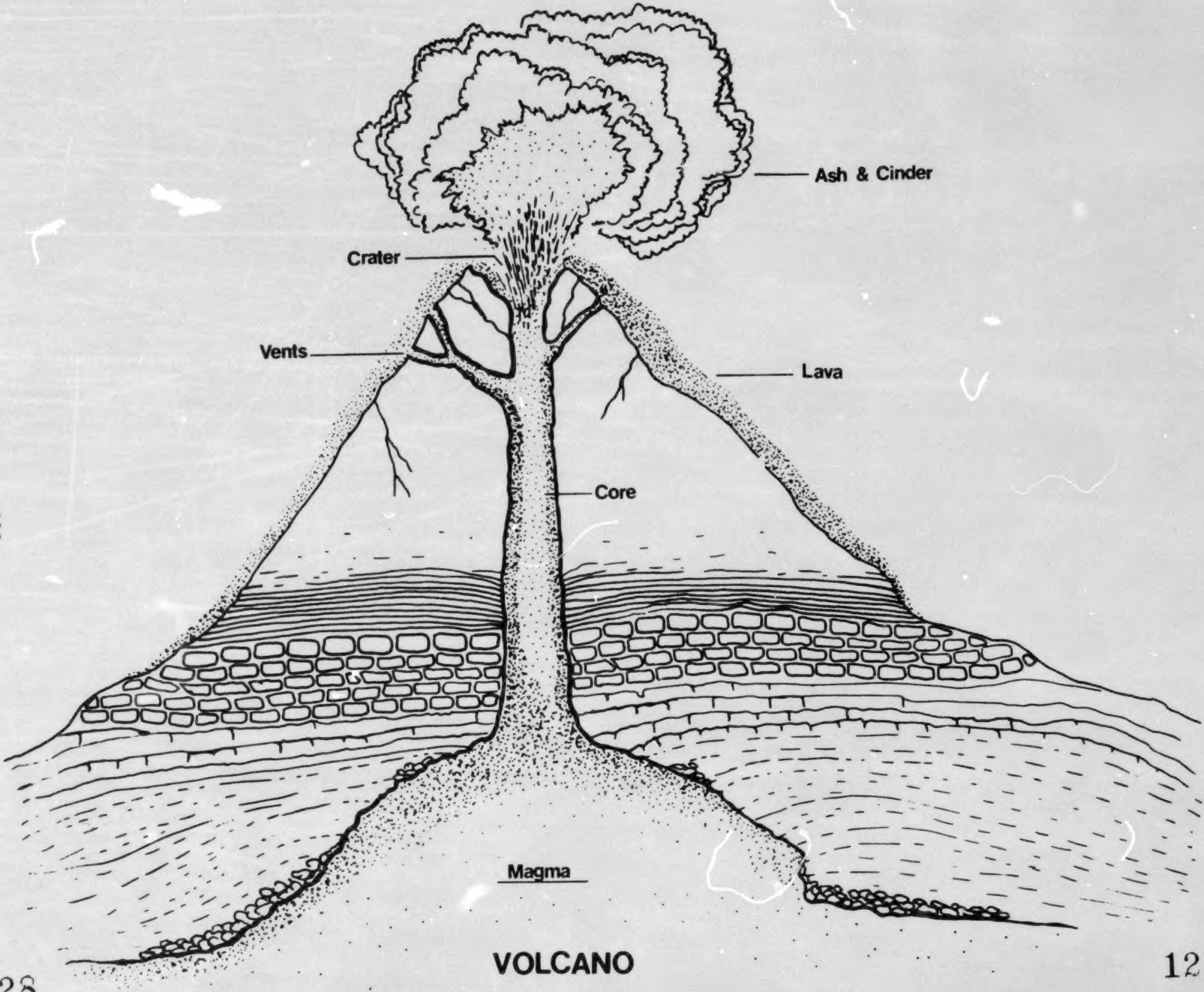
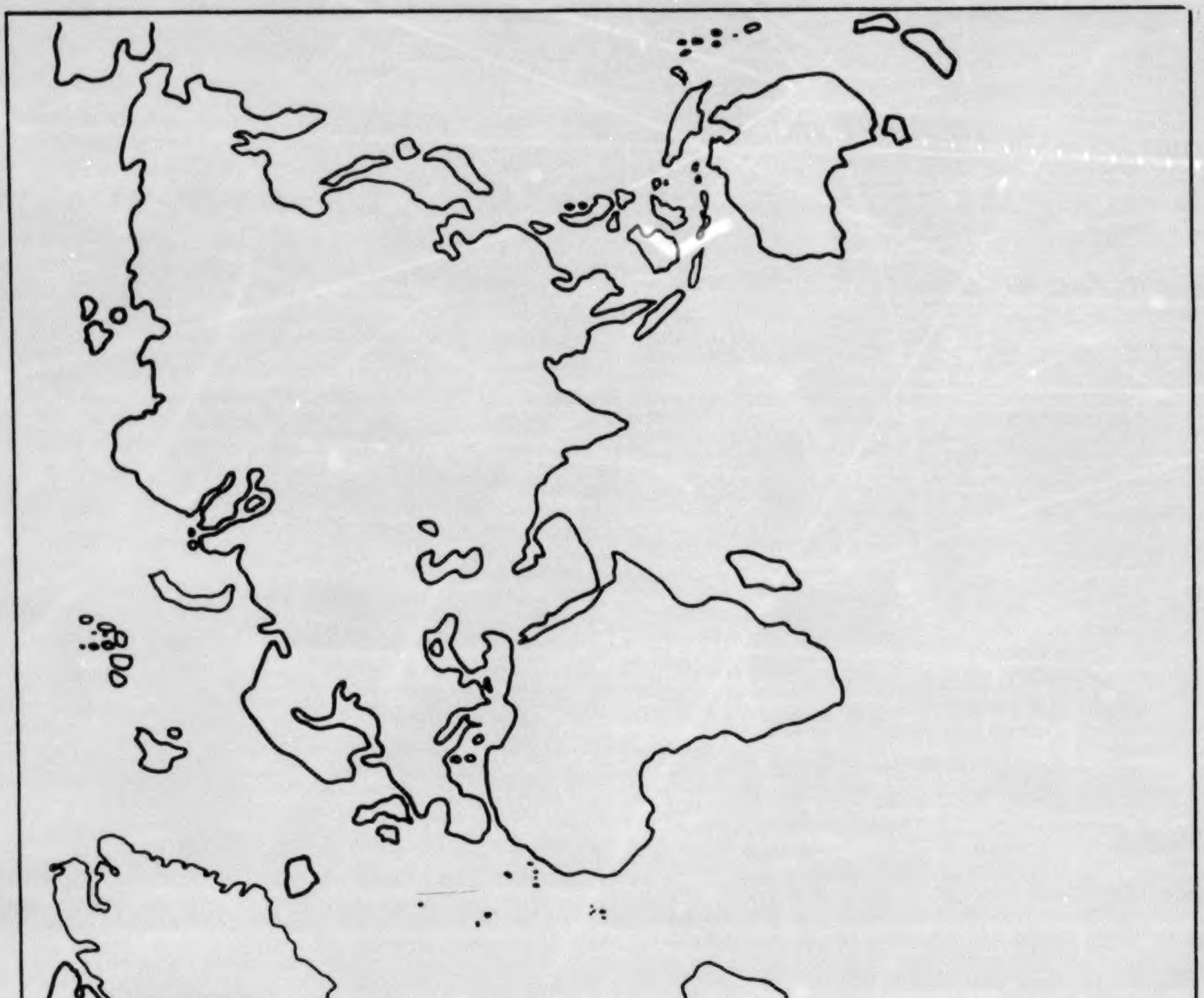
Compressed Air
Earthquake
Epicenter
Fault
Focus
Intensity
Isoseismal
Magnitudes
Primary Waves
Richter Scale
San Andreas Fault
Secondary Waves
Seismic
Seismograph
Shear Waves
Tsunami
Volcano

Seismic Risk Map of the United States


no damage
minor damage
moderate damage
major damage


Ash & Cinder
Crater
Vents
Lava
Core
Magma

VOLCANO



HOME FIRE SAFETY CHECKLIST

Name: ______________________________

Complete the following questions with your family.

1. Does your family have a fire drill plan? _______
2. Does your home have a fire extinguisher? _______
3. Why is it important to have a fire extinguisher? ________________________

    ____

4. Do you know how to operate an extinguisher? _______
5. What is the telephone number of your fire department? ______________
6. Has your family practiced a fire drill at home? _______
7. List possible fire hazards in your home:

    a. ____

    b. ____

    c. ____

    d. ____

    e. ____

8. Draw a diagram or model of your home. Using a colored pencil or crayon, show the escape routes in case of fire.

Parent's signature ______________________________

FIRE SAFETY QUIZ

Is it safe? Yes or No!

_____ 1. Your clothes are on fire. Run for help.
_____ 2. The lamp cord is too long. Cover it with a rug.
_____ 3. You have dirty, oily rags. Keep them in a metal container.
_____ 4. Your clothes are on fire. Roll on the floor or the ground.
_____ 5. A child is in the house. Put the matches on the coffee table.
_____ 6. A child is in the house. Keep pan handles easy to reach.
_____ 7. The light cord is frayed. Patch it.
_____ 8. Your family has a fire escape plan. Practice the escape routes.
_____ 9. You smell smoke. Hide under the bed.
_____ 10. You have a lot of old papers and trash. Get rid of them.
_____ 11. You have some gasoline. Keep it in a closed can.
_____ 12. You have some gasoline. Use it to start the charcoal grill.
_____ 13. A fire is burning in the fireplace. Burn trash in it.
_____ 14. The light cord is frayed. Get rid of it.
_____ 15. You smell smoke. Get out of the house or building.
_____ 16. Some people smoke. Have plenty of ashtrays.
_____ 17. You are getting new pajamas and a robe. Ask for flame-retardant material.
_____ 18. The pan is on fire. Smother it with a lid, baking soda or heavy cloth.
_____ 19. You have a fresh Christmas tree. Keep it in water.
_____ 20. Your house is on fire. Be calm. Get out quickly.
_____ 21. The house is full of smoke. Keep low.
_____ 22. You smell smoke and hear fire alarms while in a tall building. Take the elevator.
_____ 23. You smell smoke and the door feels warm. Open it.
_____ 24. You smell smoke at night; the door is warm to touch. Crawl along the floor to a window.
_____ 25. A fire is burning in the fireplace. Remove the screen so you can get closer to the warmth.

Adapted from *Disaster Preparedness: An Elementary Curriculum Guide*. Kentucky Department of Education, p. 193.

LEARNING CENTER TASK CARDS

Task cards are designed to be used with appropriate reference materials.

TASK CARD 1

PURPOSE: To investigate immediate surroundings for air pollution and the solutions to these problems.

PROCEDURE: Find out if your community has air pollution problems. How are those problems being overcome? Suggest additional solutions.

TASK CARD 2

PURPOSE: To investigate air pollution and its effects on weather.

PROCEDURE: Can you think of ways in which air pollution might affect weather? Describe a combination of pollution and weather which could produce an emergency.

TASK CARD 3

PURPOSE: To consider the possible causes of temperature inversion, the environments most vulnerable to this, and how these inversions compound air pollution.

PROCEDURE: Consider why Los Angeles is subject to inversions; name additional areas prone to this problem. Is your area threatened by inversions? Why or why not?

TASK CARD 4

PURPOSE: To identify your community's source of water and determine how it is treated and recycled for further use.

PROCEDURE: Investigate this challenge. Determine the community's source of water. What measures are taken to assure its safety? Do sewage and waste products pollute the water? Is the water monitored for pollutants?

TASK CARD 5

PURPOSE: To realize the changes in balance caused by eutrophication and what causes the problem.

PROCEDURE: Research the process of eutrophication. Trace the environmental changes that lead to the aging of a lake.

TASK CARD 6

PURPOSE: To recognize the many types of recycling possible and the benefits derived from reclamation.

PROCEDURE: List at least three examples of recycling that you have observed. Briefly explain the benefits of these recycling efforts. Then list three examples of products that are not recycled. Which of the six examples contribute to pollution problems?

TASK CARD 7

PURPOSE: To apply scientific techniques for collecting pollution data.

PROCEDURE: Select a nearby stream, river or lake. Take samples from several different areas of the body of water and run these tests:

1. physical condition (taste, color, smell, clarity)
2. pH (use litmus paper)
3. temperature
4. microscopic life

Examine each water sample, make sketches, and identify any organisms observed. Check for solids by putting water in a jar for a day or so; measure the layer depths and composition. Record your observations. Check the body of water periodically and compare the results.

If the water is polluted, consult local officials to determine the causes and methods for dealing with this.

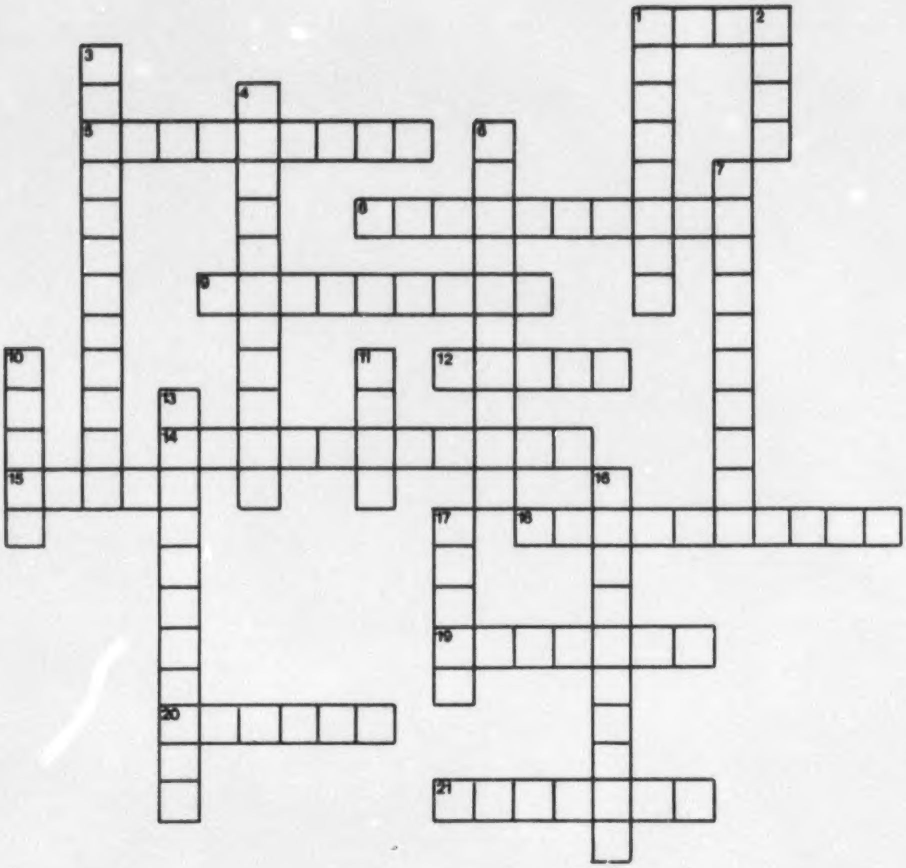
Evaluate the data and prepare a report on the findings.

TASK CARD 8

PURPOSE: To organize a survey, collect data, and to bring about positive action.

PROCEDURE: Make a pollution survey of your town. Determine the levels of air, water and noise pollution. Do chemical and solid waste cause problems? Photograph the sources of pollution and report the results to your class, local newspaper and television station.

AIR POLLUTION CROSSWORD PUZZLE



Across

1. The __________carries air pollution to other areas
5. A sickness one gets from fallout
8. A transportation vehicle which pollutes the air
9. Manufacturing plants which often pollute the air
12. Diffused matter as smoke or fog suspended in the air making it thick and heavy
14. An organism's entire surroundings
15. Substances that are irritants in the atmosphere
18. A chimney or pipe that discharges smoke into the air
19. The escape of gases into the air from an engine
20. An odorless gas necessary for breathing
21. Radioactive particles in the atmosphere resulting from a nuclear explosion

Down

1. All untamed animals and uncultivated plants
2. Fine particles of dirt in the air
3. Solid unburned particles formed when fuels are burned
4. Being capable of giving off particles of radiation
6. A layer about 15 miles above the ground which protects the earth from the sun's ultraviolet rays
7. Chemicals used on crops to kill insects
10. A part of the living body affected first by air pollution
11. A mixture of smoke, fog and waste gases
13. Air pollution may cause __________ diseases, such as emphysema
16. The process of burning
17. The gases which escape from an exhaust pipe

POLLUTION PUZZLE - ANSWER KEY

Across:

1. wind
5. radiation
8. automobile
9. factories
12. vapor
14. environment
15. gases
18. smokestack
19. exhaust
20. oxygen
21. fallout

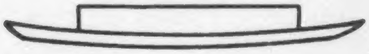
Down:

1. wildlife
2. dust
3. particulates
4. radioactive
6. ozone layer
7. pesticides
10. lungs
11. smog
13. respiratory
16. combustion
17. fumes

CLOUD CHAMBER

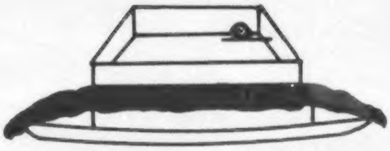
INSTRUCTIONS

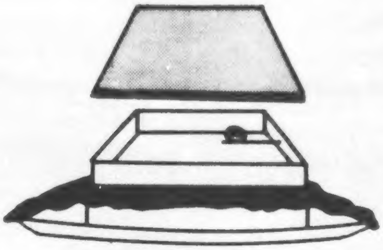
1. Place dry ice in a shallow container.



2. Place a piece of black material over the dry ice.

3. On top of the material, place an open-topped glass dish approximately 4-5" in diameter.
4. Attach a needle to the inside of the dish with glue.
5. On the projecting end of the needle place a radioactive sample





6. Saturate a sheet of cardboard with alcohol and place it on top of the glass container.

7. Cut off lights and observe the cloud tracks produced by radiation.

GUIDE FOR SHELTER PLANNING

HOME SHELTER CHECKLIST

Location in Home:

Storm Shelter	Fallout Shelter

SUPPLIES AND STOCK

_____ batteries

_____ battery-powered radio

_____ bedding

_____ books, magazines, games

_____ clothing

_____ cooking and eating utensils

_____ fire-fighting equipment

_____ first aid and health items

_____ flashlight

_____ food

_____ medicines

_____ sanitation items

_____ toiletries

_____ water

PUBLIC SHELTER CHECKLIST

PUBLIC SHELTER	LOCATION	ROUTE
Nearest Home		
Nearest Work		
Nearest School		

SUPPLIES TO TAKE TO SHELTER

_____ battery-powered radio

_____ blankets

_____ flashlight

_____ food

_____ medicines

_____ potable liquids

_____ toiletries

*U.S. GOVERNMENT PRINTING OFFICE: 1981-0-726-355/133